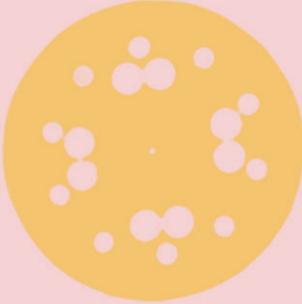
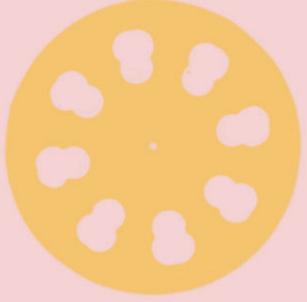
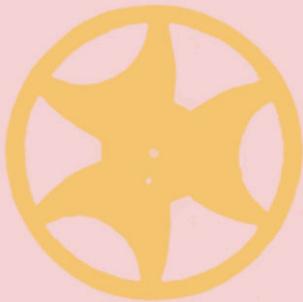
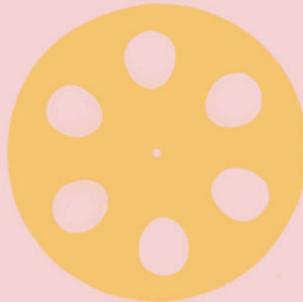
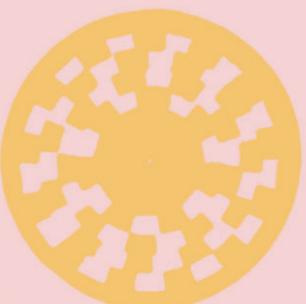
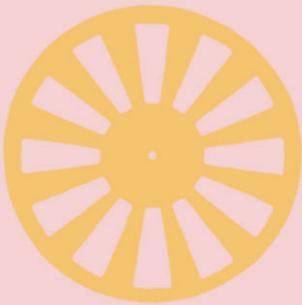


# geometry of sound





**Synthetic music, dispensing with completely “performers”, on the one hand, does not require mechanical reconstruction of musical instruments - on the other hand, it easily carries out any intonation problems, such as obtaining a clean acoustic system and gliding movements of any speed. All this, of course, but at the present stage, many of the listed features have already been implemented. I turn to those for whom all these problems are relevant, who look lovingly into the future and do not go on beaten paths, I turn to them with a puzzled question: how did it happen that for ten years now, scientific work has been conducted that has not attracted composer’s attention in our USSR.**

**These technologies can result in a grandiose shift precisely in the above direction! I am talking about synthetic music on sound film. I am talking about synthetic music on sound film. With all the rest of my statement, I’m trying to prove that in a maximum of 2–3 years this is exactly the way Soviet composers will get their hands on a perfect and obedient apparatus for realizing arbitrarily bold creative ideas, a universal “super-orchestra under the author’s control” that does not know the limits of virtuosity, expressiveness, accuracy of any given system, variety of timbres.**

\*

**Arseny Avraamov ‘Soviet Music magazine’, 1939**

2

# geometry of sound

# index

Preface

**Documentary**  
Introduction

1

Data gathering  
Archives  
Museum

2

Reseach  
Texts  
Films

3

Prototyping and development  
Scenario  
Drafts

4

Film  
\* Posters

**Sound Experiments**  
Introduction

5

Research  
Techniques and programms

6

Prototyping and development  
Darkroom  
Drafts

7

Website

8

References



# 6

# preface



my interest in electronic music took me to its origins, namely, themes of graphical sound and synthetic music. This is a forgotten layer of history that is not much known about. Thanks to Soviet inventors, engineers and physicists their inventions and ideas, electronic and synthetic music appeared. In the 30s they explored the field of 'graphical sound', exploring the relationship between man and machine, sound and image they sought to uncover the universal truths of geometry, art, film and music. It was their inventions and ideas that influenced the development of electronic music. This is a forgotten layer of history that is not much known about. This project, on the one hand, explores history through a documentary, and on the other hand, it is the embodiment of

those methods that were invented earlier. This project has two parts and two formats in which I explore themes: graphical sound and synthetic music. The first part is a documentary film which covers the theme of graphic sound. The second part is sound experiments that have switched to the form of the collection, which is presented on the site. Unfortunately, due to the current pandemic situation, many plans were not implemented. I would like to express special thanks to the employee of the Russian National Museum of Music Irina Nikolaevna Novichkova, as well as to the Russian State Archive of Film Documents in Krasnogorsk and the Russian State Archive of Phono-Documents for the material provided.



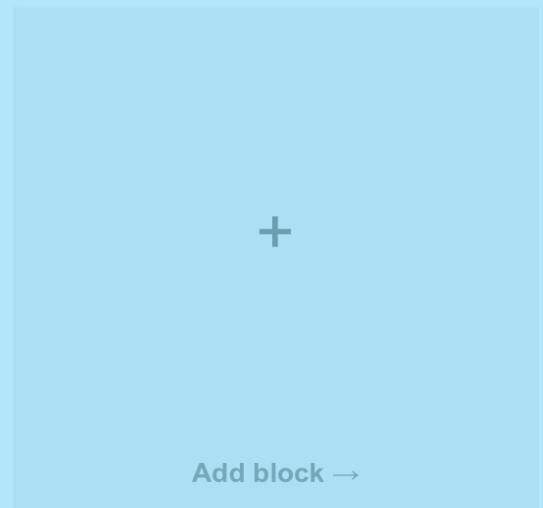
# documentary

12

# introduction

**It all started with the collection and search for information about graphical sound. In the are.na I found a channel (russian drawn sound) where there were only 5 pictures with links to the video. This was the starting point of this journey.**

Q Filter russian drawn sound.s (5 blocks)



Add block →



00v

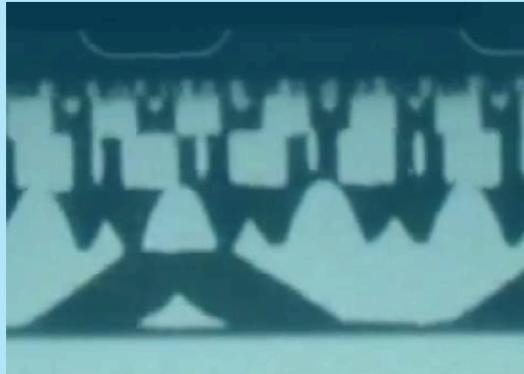


1930s Russian Drawn Sound: Nikolai Voin... ▶

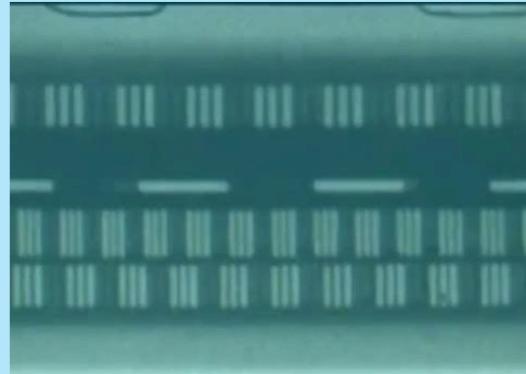
1930s Russian Dr...



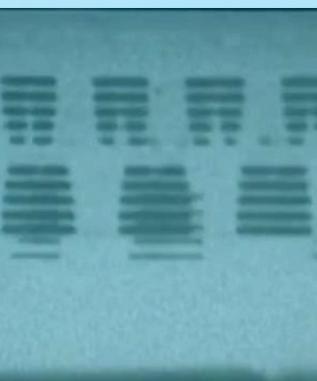
oinovsound.jpg



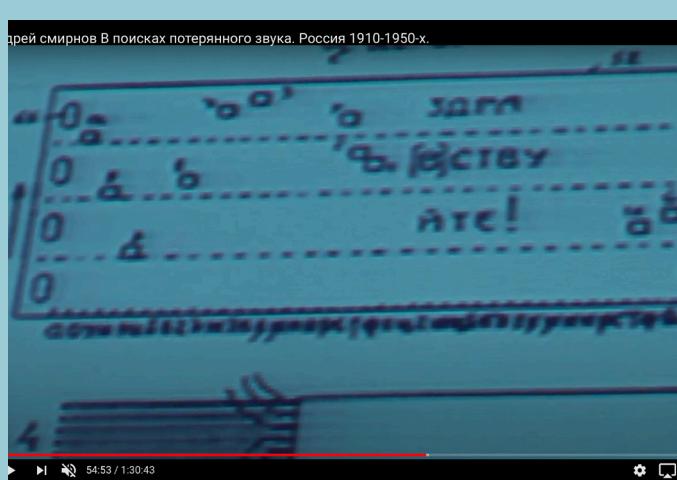
1930s Russian Drawn Sound: Arseny Avra...



1940s Russian Drawn Sound: Les Vautours



awn Sound: La Suite Cab...



Screenshot from youtube.

Andrey Smirnov. In search of the lost sound.  
Russia 1910-1950's.

Screenshot from youtube.

GENERATION Z. Pioneers of Russian music technology of the 1910-30s  
Exhibition at the Polytechnic Museum, March 11 - May 14, 2011 'Sound from light and paper. History and practice of Graphic Sound.'  
Lecture concert dedicated to the 120th anniversary of the birth of Eugene Sholpo.  
Participants: Marina Sholpo, Nikolay Izvolov, Andrey Smirnov, 2011. Graphic Sound Hall.

**There is not much information and material on the Internet, mainly all articles, lectures were made by one person, Andrei Smirnov, and translated into different languages.**

Лекция «Оптический синтез и Графический звук» 2017 ...

28 февр. 2017 г. - Лекция «Оптический синтез и Графический звук» 28 февраля 2017, Московский музей современного искусства на Тверском бульваре в ...

[www.facebook.com](http://www.facebook.com) › events › sound-museum › евгений...

**Евгений Стрелков. Графический звук в медиа-арте**

Event in Saint Petersburg, Russia by Sound Museum - Музей Звука on Thursday ...  
Графический звук – это перевод в звук различных графических объектов ...

[www.ncca.ru](http://www.ncca.ru) › events

**ГЦСИ - Москва. АНДРЕЙ СМИРНОВ. ГРАФИЧЕСКИЙ ЗВУК ...**

ГРАФИЧЕСКИЙ ЗВУК И ОПТИЧЕСКИЙ СИНТЕЗ. Лекция. 11.03.2015, 19:30 среда. Евгений и Ольга Шолло за Вариофоном первой модели. Ленинград.

[ru.dreamstime.com](http://ru.dreamstime.com) › ... › Телекоммуникация ▾

**графический звук иллюстрация штока. иллюстрации ...**

иллюстрации около черный нижний цифровой графический звук. иллюстрации насчитывающей топо, танцуя, график - 4492362.

Техника графического звука — уникальный метод синтеза звука с помощью света и искусственно созданной графики звуковых дорожек. В 1929 году ...

[mmoma.timepad.ru](http://mmoma.timepad.ru) › event ▾

**Лекция 3: «Графический звук» и «оптический синтез ...**

Лекторий ММОМА. Модуль 1: Современное искусство и музыка. Лекция 3: « Графический звук » и « оптический синтез »

Вы посещали эту страницу несколько раз (2). Дата последнего посещения: 27.04.20

[mmoma.timepad.ru](http://mmoma.timepad.ru) › event ▾

**Лекция 2. Оптический синтез и Графический звук ...**

Звуковое кино и «графический звук». Арсений Аврамов и Оскар Фишингер ( Германия )

— «корнаментальный звук» (1930); Николай Войнов, «бумажный ...

Вы посещали эту страницу 13.05.20.

[habr.com](http://habr.com) › post ▾

**Технология «рисованного звука»: синтез звука в СССР 30 ...**

10 июня, 2013 г. - Она позволяла методом искусственного создания графики звуковых

дорожек на кинопленке синтезировать любые звуки, эффекты, ...

Вы посещали эту страницу несколько раз. Дата последнего посещения: 23.05.20

[asmir.info](http://asmir.info) › lib › gsound ▾

**Лекции Андрея Смирнова. Электроакустическая музыка в ...**

... искусственно создание графики звуковых дорожек на кинопленке синтезировать любые звуки, эффекты, записывать сложные полифонические ...

Вы посещали эту страницу 22.05.20

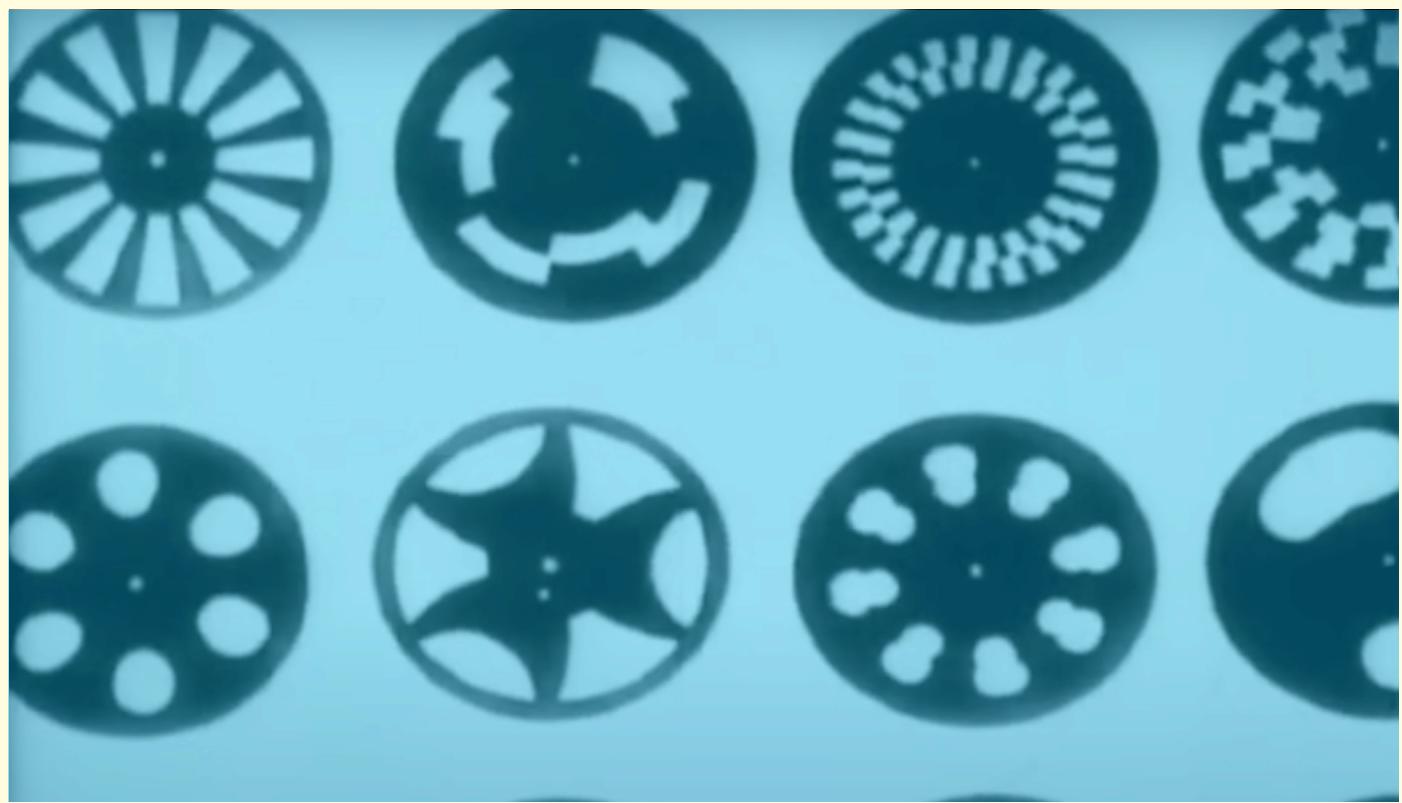
**Screenshot from google search**

**Screenshot from google search.**

for the first tutorial 03.02.2020 I prepared a presentation, with the information I found on the Internet. Where, in addition to information and references, there were the names of people connected with this topic, basic terms, a list of films that were voiced using graphic sound technology, a list of musical compositions, a list of magazines, books, articles, and a list of places where I can find more information to study my theme.

## Graphical sound. The forgotten history of Soviet experimental music of the early XX century.

Presentation page1



Presentation page 2

## Leonardo Da Vinci Society, 1917



Sergei Dianin undertook a mathematical analysis of acoustics and music theory;



Arseny Avraamov focused on the philosophy and sociology of music



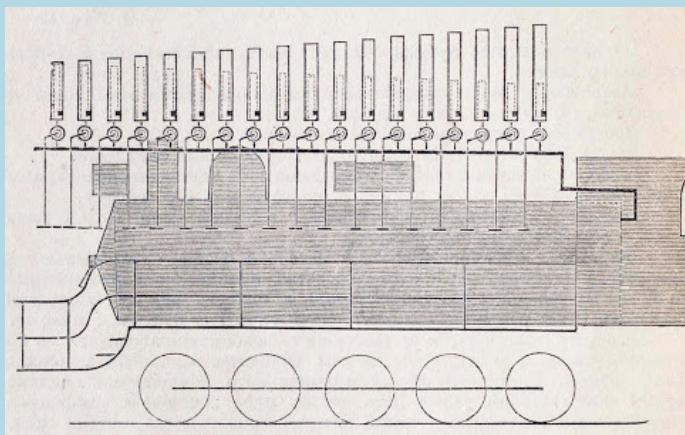
Evgeniy Sholpo, inventor of Variophone

Their objective was to unite efforts to produce a revolution in music theory and techniques based on the cross-connection of the arts and sciences. They declared that academic views on music theory were dull and scholastic, and that techniques relating to it were old fashioned, proclaiming that both were becoming increasingly outdated.

## Presentation page 3

Leonardo Da Vinci Society - a group of engineers who were engaged in the problem of artificial sound, and were also pioneers of graphic sound.

## Presentation page 4



## Presentation page 5

A. Avraamov - Symphony of Industrial Horns (1922) this was first performed in Baku, Azerbaijan, for the 5th anniversary of the October revolution. avraamov can be seen in a photo conducting the symphony with two flaming torches.



## Presentation page 6

scheme of the variaphone by Eugeny Sholpo, which he constructed in 1931.

**List of people:**  
Evgeny Sholpo  
Nikolai Voinov  
Arseny Avraamov  
Boris Yankovsky  
Mikhail Tsihanovsky  
Sergei Dianin  
Rimsky-Korsakov  
**Norman McLaren (CA)**  
Andrey Smirnov  
Nikolay Izvolov  
Maria Sholpo

**List of terms:**  
Hand-drawn Ornamental Sound  
Hand-made Paper Sound  
The Variophone  
The Syntones method  
Audio Computing

**List of films and cartoons:** The Five Year Plan for Great Works (Пятилетка) (1930)  
Pochta (1939)  
Stervyatniki (1941) the movie, maybe is completely lost, there is only sound recordings  
The thief (1934) is not released and therefore not mentioned in any filmography  
Zvuchashaya Rukopis (1932)

[Presentation page 6](#)  
[Presentation page 7](#)  
[Presentation page 8](#)

**List of music:**

Rachmaninov Prelude (1932)  
The Dance of the Crow (1933)  
Les Vautours (1940)  
La Suite Caburateur  
Rimsky-Korsakov compositions

**List of references:**

Avraamov, Ars. "Sinteticheskaya muzika" Sovetskaya Muzika , 1939  
Tsekhanovsky M. "O Zvukovoi Risovannoii Filme." Kino i Zhizn, Moscow. 1930,  
Yankovsky, B. "Analiz i sintez tembra" (Analysis and Synthesis of Timbre) March, 1935  
Kaganovsky L. Sound, Speech, Music in Soviet and Post-Soviet Cinema, 2014  
Proletarian cinema (magazine), 1930  
The art of cinema, USSR 1945  
Soviet music (magazine),1933

**Week Schedule:** Russian film archive: Net-film — Tuesday

Russian State Film and Photo Archive – Wednesday

Krasnogorsk Archive of documents – Thursday

Russian state library – Friday

[Presentation page 9](#)  
[Presentation page 10](#)  
[Presentation page 11](#)

24

**after the first week I decided on  
the format for the final outcome.**

1

26

# data gathering

28

# archives

29



**The Russian State Archive of  
Film and Photo Documents  
is an archive of documentary  
newsreels and photographs  
located in Krasnogorsk.**

**Visits to the film archive were  
necessary to develop research  
on my project, as well as to  
collect material.**



**Film Archive**

## First visit to the film archive.

When I named my topic, museum staff said that they most likely have nothing. But after a few hours in the cinema department, I found all the cinema and phono materials, there were about 30 of them, but only 2 films were available. The first one with Eugene Sholpo, the second with illustrations for graphical sound.



There were about 15 to 20 phono materials, but the problem was that there wasn't any equipment in the film archive to listen to, but they couldn't give it in my hands so that I could listen in the phono archive. Photographing and filming was prohibited there, but I managed to create a couple of photographs.





## Задайте параметры запроса

[Правила задания запроса!](#)

Учетный номер документа :

Название, аннотация и ключевые слова :

Название :

Авторы :

Студия :

Дата выпуска :

 год

или

от  года до  года[Сброс](#)

Вы так же можете воспользоваться Каталогом кинодокументов РГАКФД

Показать  
● ●

Помощь ?

В каталог включено более 8 500 документов.

Заполнение каталога продолжается.

Программное обеспечение разработано в ИПМ им М.В.Келдыша РАН



[www.keldysh.ru](http://www.keldysh.ru)



[www.rusarchives.ru](http://www.rusarchives.ru)

5

Videocatalogue of film archive  
In which I was searching films about graphical sound.

35

Джан Галиев 1934

К-1 Барнаул

Гомзобек 1934

38801 (1)

38286 (2)

38287 (1)

38289 (1)

38291 (1)

38299 (1) 38417 (1)

38307 (1) 38429 (1)

38928 (1) 38298 (1)

Интернационал  
Марин - третий и четвертый  
Анастасионич (1934-  
1941)

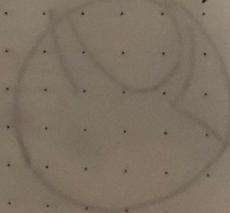
Бодорев

Марин Абдуллов

1. По берегам  
Кокто (1909-1917)

Маринов.

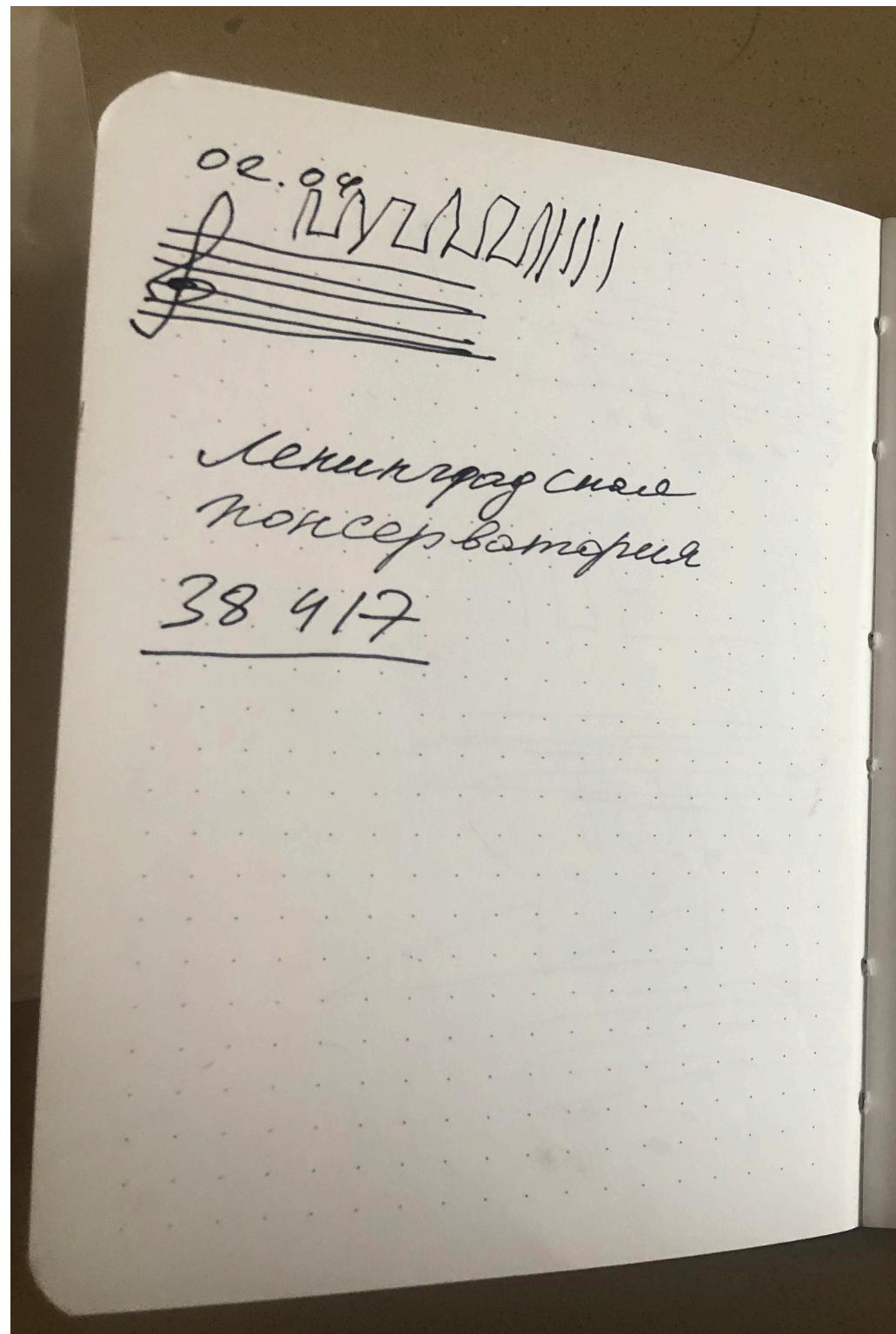
38413 (1)



2. Коппинга 38418  
1910-1930

FL

Notes from first visit



- 1) Страна из карбонатов  
1933 (Москва)
- 2) Дядя Федор "Не  
изумляй" 1934  
Москва
- 3) К. о. п. Скважка  
(19100

Неприменима для  
отделки пола из-за газов

FL

- самоцветы  
и гидровиалы
- Бронзовники  
цветущие на ветвях
- меса
- горнолесные  
растения с монодомами  
на склонах
- чистотел
- сампепа
- фрукты (4 языка)
-

докладамерикан  
 nocturne № 5  
 посвященного пра-  
 гица Monet)  
 Барнхорн

VI - панегири

Барнхорн (

По берегам Конса

1909-1917

7

2.02.20

- Программист зеун гимназии  
представ. зеун гимназии  
гимназии макаров
- имена
- историки
- зеун
- архив
- библиотеки
- имена
- архивы / зеун
- имена
- Абрамов
- Николай Маликов
- Егорий Соколов
- Александр Мороз
- Борис Ильинский

- прошлого и впереди
- Мария
- Егорий Мороз
- the enemy of usci
- архивы
- библиотеки
- 60 - 80 years
- Собчаков Вяч
- 
- Имена.
- второй архив
- зеун библиотеки



## Second visit to the film archive.

01.49 - 01.50 2  
01.58 - 01.60 2  
02.15 - 02.17 3  
02.23 - 02.25 2  
9  
02.30 - 02.32 2  
02.36 - 02.37 2  
02.43 - 02.44 1  
02.50 - 03.01 11  
~~03.06 03.07~~

- 00.24  
- 00.28  
- 00.31  
- 00.34  
- 00.37

Timecodes

Timecodes

At the second visit, I wrote out time codes so that my employees could rewrite the material to the USB flash drive. And also continued to search for video materials.

0.0  
28

1.43 - Жуно просит  
2.03 нрф нсн

12 сонато  
БЕТХОВЕН

00.29 - 00.35  
00.43 - 00.50  
00.59 - 01.19  
01.31 - 01.36  
01.44 - 01.50

05 - 00.07 2  
15 - 00.17 2  
22 - 00.24 2  
26 - 00.28 1  
30 - 00.31 1  
33 - 00.34 1  
36 - 00.37 1  
2 - 00.43 1  
~~8 - 00.50 2~~

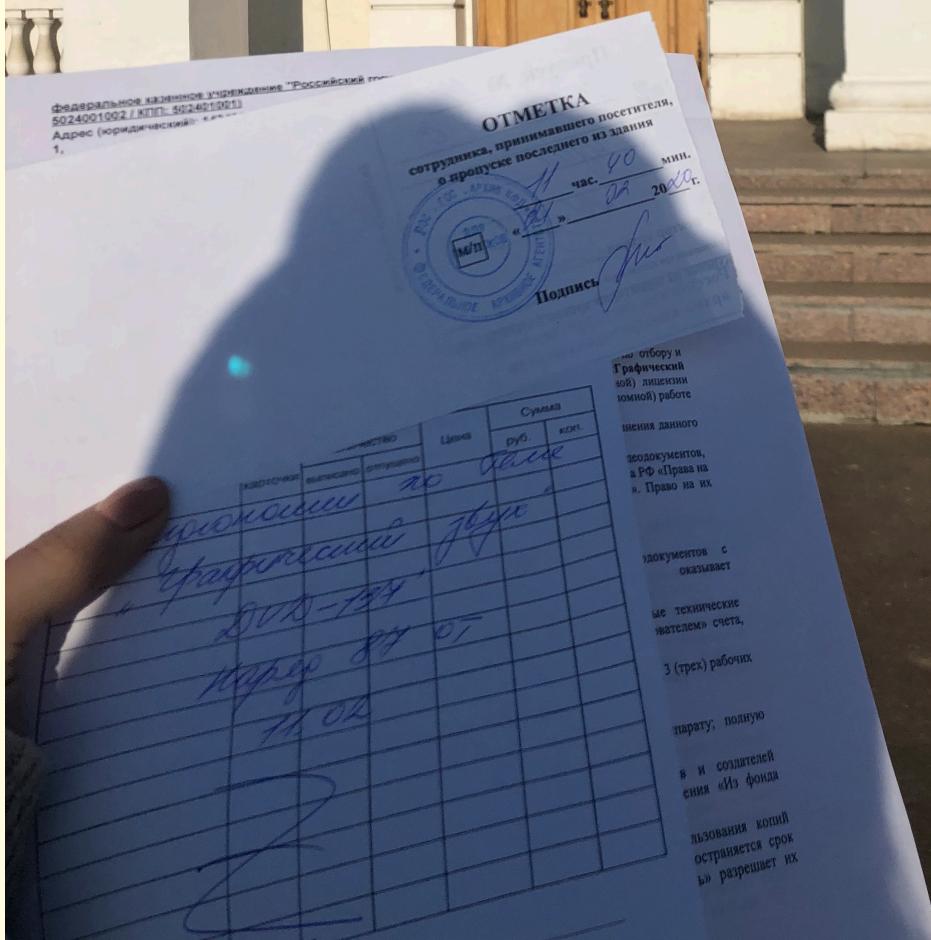
Timecodes

Timecodes

# 21.02

last visit  
I took the stuff!

# 46





**The Russian State Archive of  
Phono-Documents is an archive  
created for storing sound  
recordings covering the history  
of culture and the chronicle of  
socio-political life. This was the  
second archive that I visited.**

**Phono archive**



50

**The 1st building of the phono-archive**  
It was difficult to find the entrance to the phono-archive itself, since there were no signs; besides the phono-archive, there is also an archive of historical documents in this building.



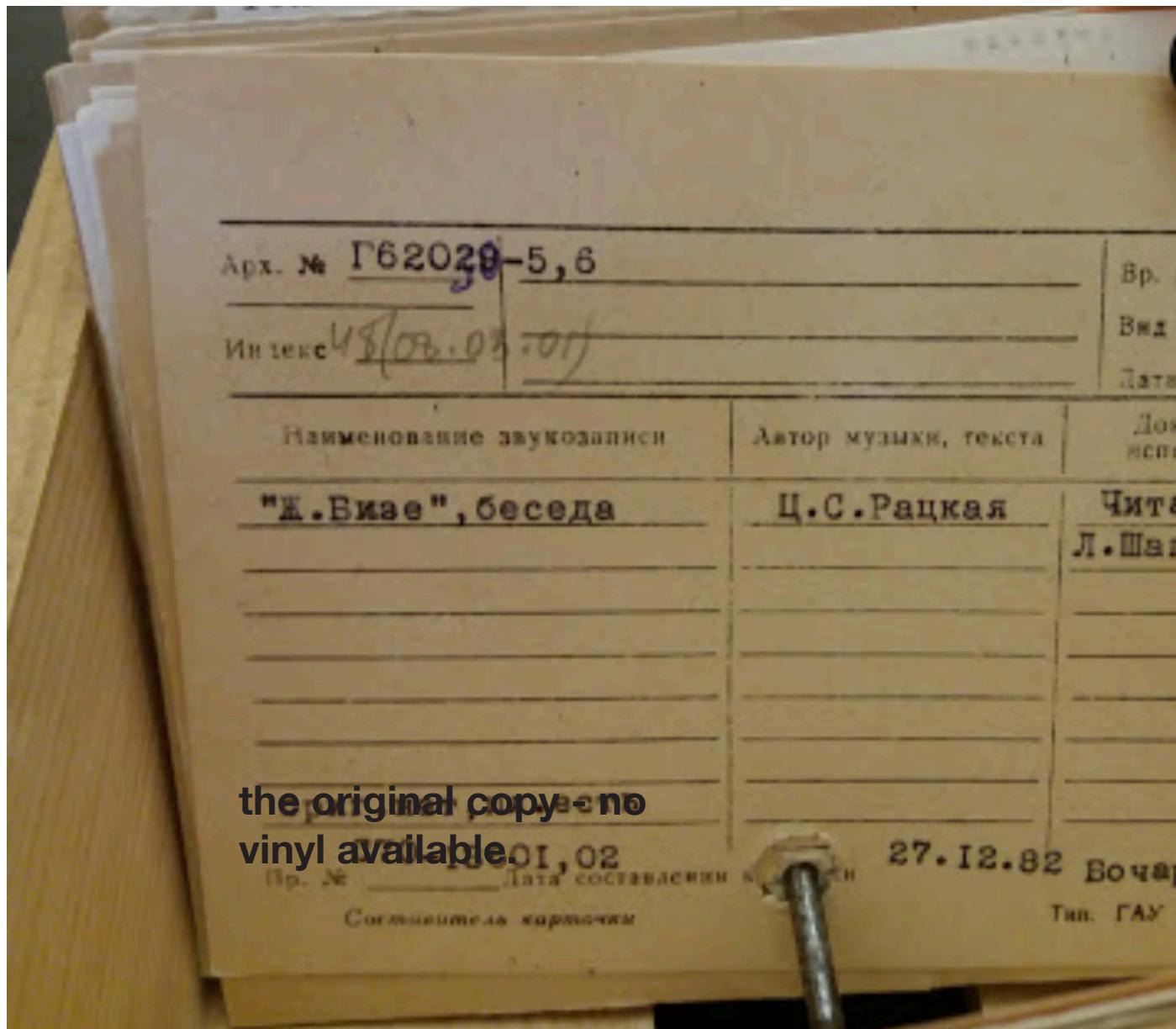


52

unfortunately, having looked through almost all the boxes, I did not find the material that I need.



boxes with archival materials. The first three letters are the beginning of surnames.



54

after a long look at these cards, I realized that some of them are stamped — there is no original copy and no record, this means that this material has been lost or destroyed, but the cards are still stored in the archive.



**Эмиль Берлинер  
(1851 – 1929)**

Американский изобретатель. В 1887 г. запатентовал новое устройство — граммофон. В 1895 г. основал «Berliner Gramophone» — первую компанию, занимавшуюся продажей граммофонных записей. Через два года открыл филиал в Великобритании — Gramophone Company (в настоящее время EMI — одна из крупнейших звукозаписывающих компаний мира), ещё через год — в Германии (Deutsche Grammophon).

which was surprising for me that they even had a small museum space as a wall with a sideboard in which there were mules of the first records, musical instruments and photographs of inventors and musicians.



**Unfortunately, as well as the film archive, the phono archive is a forgotten place by God, there was not enough material for my theme. And strangely enough, there was more foreign material than Soviet. It's a pity that our archives are in this state, it seems that after 5-10 years everything will fall apart and generally cease to exist.**



# museum

ГОСУДАРСТВЕННЫЙ  
ЦЕНТРАЛЬНЫЙ МУЗЕЙ  
МУЗЫКАЛЬНОЙ КУЛЬТУРЫ  
им. М.И.Глинки



**Federal State Budgetary  
Institution of Culture «Russian  
National Museum of Music»,  
previously - the All-Russian  
Museum Association of Musical  
Culture named after M. I. Glinka  
is a museum association that  
includes branches throughout  
Moscow. The main building is  
located on Fadeeva street, 4**

**Museum of music**

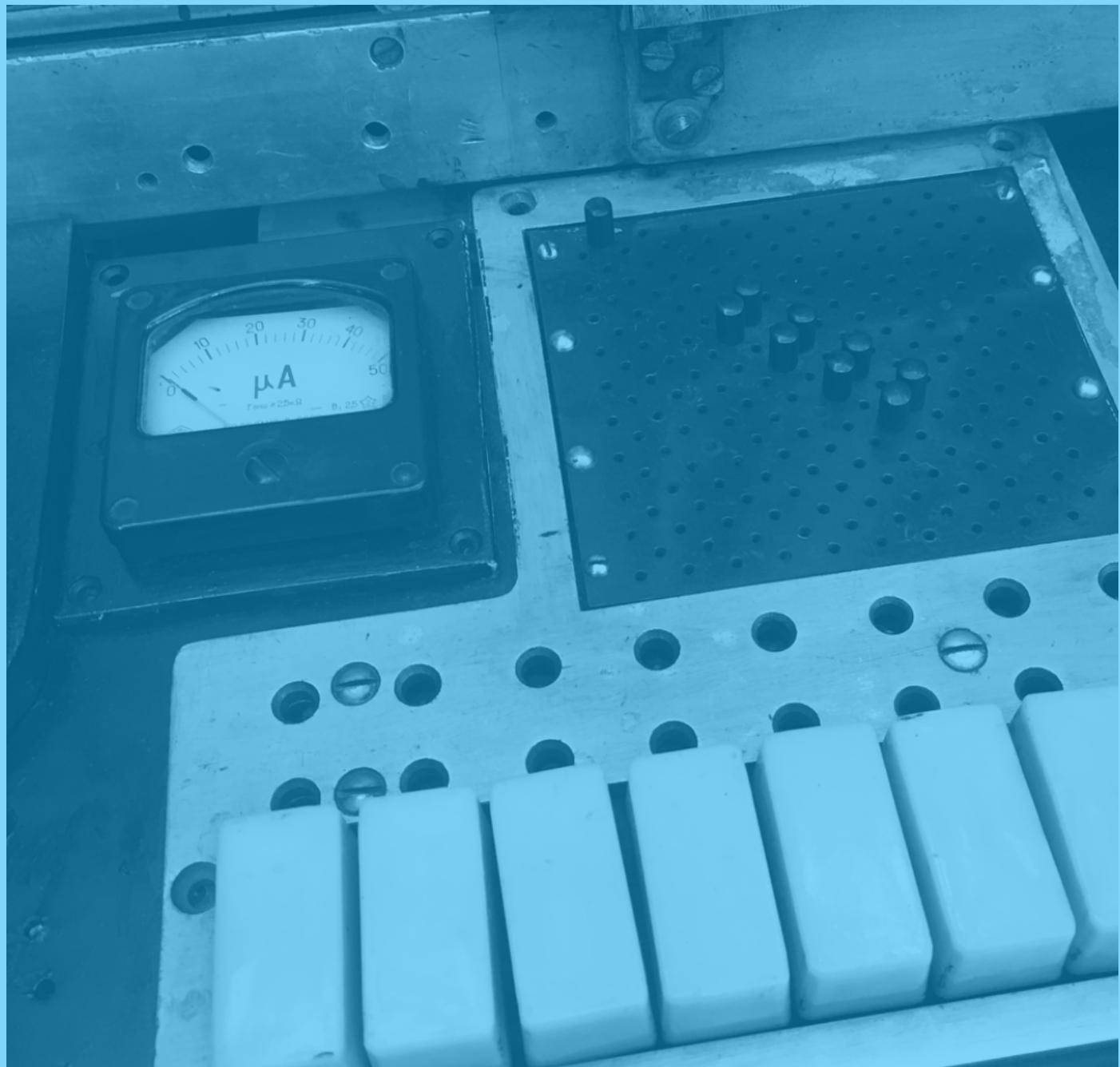
first visit to the museum

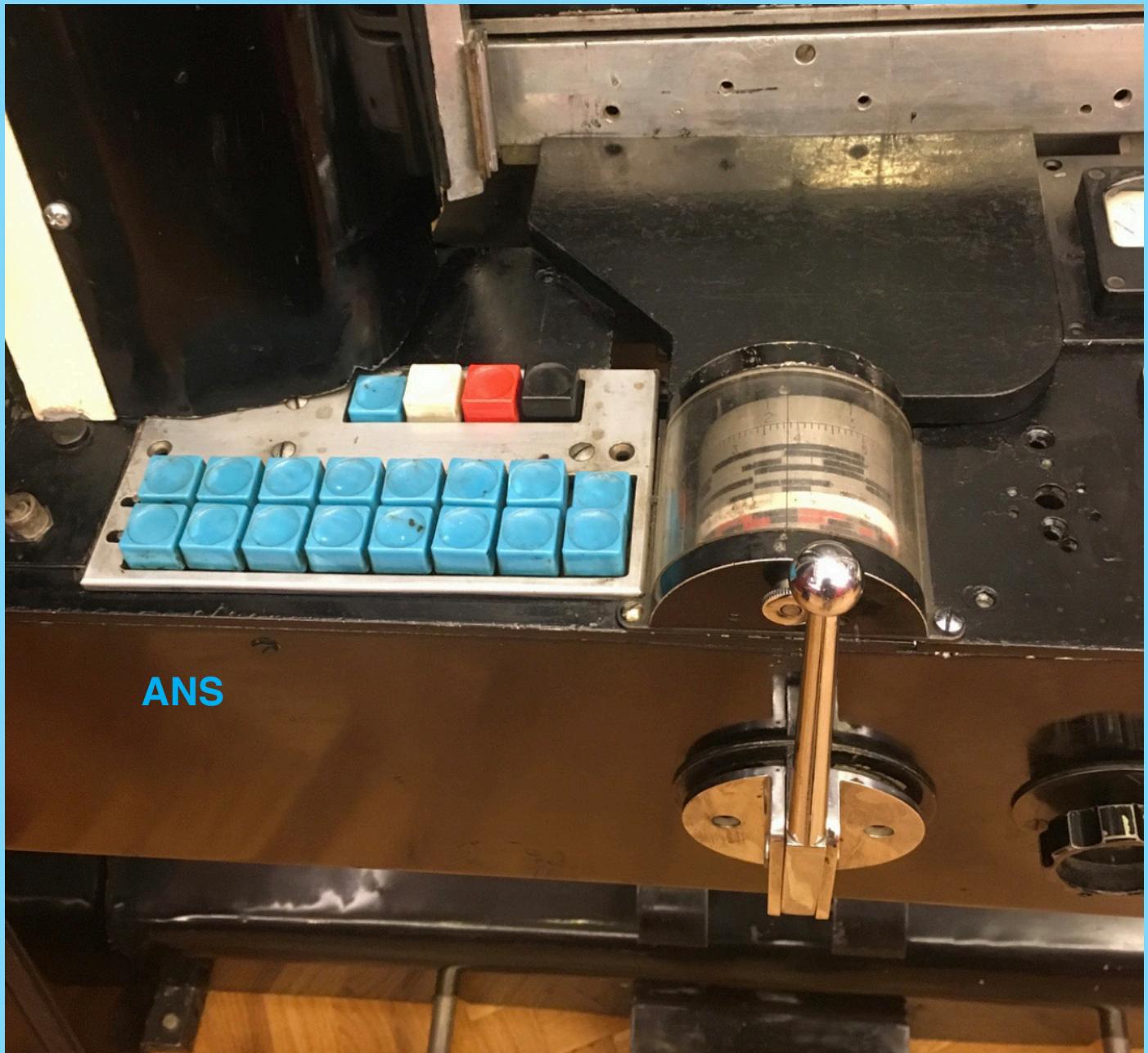


I visited an exhibition of instruments and on this visit I asked if they had employee or guide who could give me an interview on the topic of graphical sound. I was taken to the department of communication and public relations and they said that I need to write statement letter addressed to the director of the museum.



## first visit to the museum





ANS

## first visit to the museum

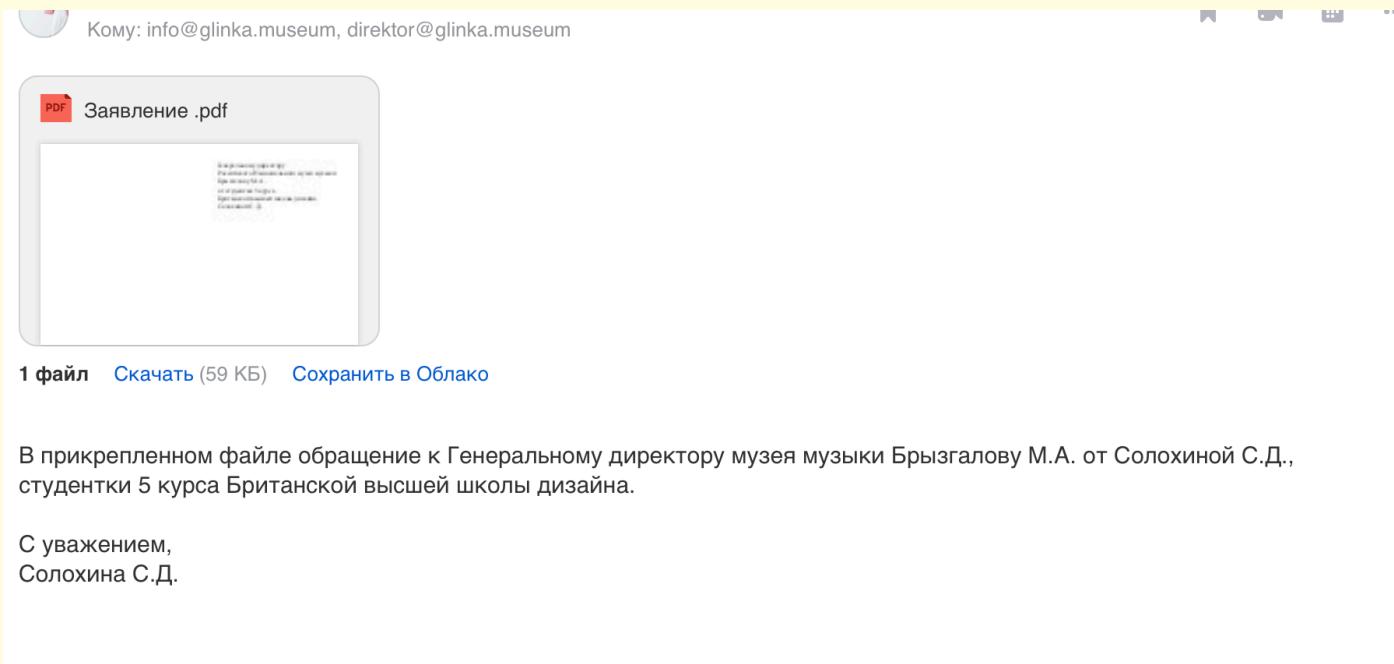


the ANS synthesizer



# 20.02

Second visit and statement letter



Кому: info@glinka.museum, direktor@glinka.museum

PDF Заявление .pdf

1 файл Скачать (59 КБ) Сохранить в Облако

В прикрепленном файле обращение к Генеральному директору музея музыки Брызгалову М.А. от Солохиной С.Д., студентки 5 курса Британской высшей школы дизайна.

С уважением,  
Солохина С.Д.

screenshot of the  
attached letter with the  
statement

The second visit was on **February 27**, although I wrote a letter on **February 20**, I called every day until they called me back and said that they could not find the letter and I needed to come and hand it in personally, on **February 27** I came to the museum and gave the letter.

## Translation

Генеральному директору  
Российского Национального музея музыки  
Брызгалову М. А.  
от студентки 5 курса  
Британской высшей школы дизайна  
Солохиной С. Д.

Much-esteemed  
Mikhail Arkadevich!

I ask you to allow  
an interview and  
filming with one of  
the employees of the  
Museum of Music  
(4 Fadeeva Street)  
as part of a diploma  
project on the topic  
“Graphical (Drawn)  
Sound in the USSR”.  
Filming an interview is  
necessary to include  
this fragment in a  
documentary film,  
which will be devoted  
to the study of graphic  
sound obtained using  
a variophone. During  
the interview with the  
guide, it is planned to  
discuss the principles  
of the variophone,  
the ans, nivotone and  
theremin, its use in  
cinema and animation,  
as well as the story of  
the creation.

Глубокоуважаемый Михаил Аркадьевич!

Прошу Вас разрешить провести с одним из сотрудников Музея Музыки (улица Фадеева, 4) интервью и его съемку в рамках выполнения дипломного проекта по теме «Графический (рисованный) звук в СССР». Съемка интервью необходима для включения этого фрагмента в документальный фильм, который будет посвящен изучению графического звука, полученного с помощью вариофона. В ходе интервью с экскурсоводом планируется обсудить принципы работы вариофона, его использование в кино и анимации, а также историю создания вариофона Евгением Шолпо.

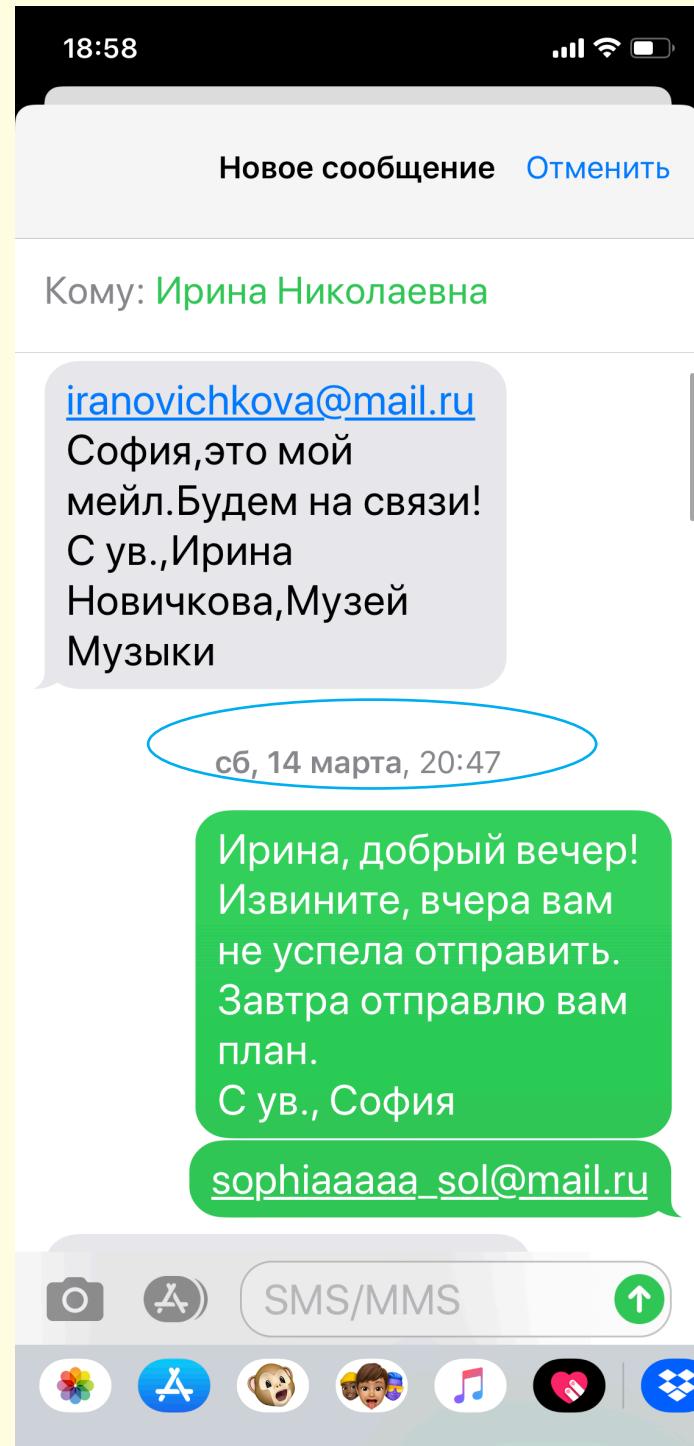
20 февраля 2020 г.

 \_\_\_\_\_ /Солохина С.Д./

70

# canceled interview

Third visit and acquaintance with Irina Novichkova.





Кому: iranovichkova@mail.ru



**Добрый вечер! Извините, что так поздно высылаю вам план.**

## План

1. История графического звука. ( краткая историческая справка)
2. Родоначальники графического звука (краткая биография)
3. Евгений шолпо
4. Арсений Авраамов
5. Евгений Мурзин
6. Лев Термен

Рассказать про их взаимосвязь с графическим звуком и про их изобретения

Вариофон

Синтезатор анс

Терминвокс

С уважением,  
София

The third visit took place only on March 14, I still called every day, but each time the museum staff said that they had an event or a meeting. On March 12, Irina Nikolaevna herself called me she is scientific employee of the museum and we planned a meeting on March 14.

On this day, she gave me a tour and said she was interested in my project and will be happy to give me an interview. We agreed to meet on the 16th and discuss all issues in detail.

16.03

Fourth visit

74

**discussion of all  
questions and  
appointment  
dates for filming  
interviews.**

**The date was set  
for March 23th**

# interview day

**CANCELED and  
the date was set  
to March 24th**

**76**

23.03

Новое сообщение    Отменить

Кому: Ирина Николаевна

София, я Вам завтра  
утром позвоню. Или Вы  
меня наберите, ок? С  
ув., Ирина

Хорошо! С ув., София

пн, 23 марта, 14:20

Этот абонент снова в  
сети, вы можете с ним  
связаться

вт, 24 марта, 19:26

Ирина, хочу  
 поблагодарить вас за



SMS/MMS



77

**24.03**

**the date was set  
to March 25th**

Новое сообщение Отменить

Кому: Ирина Николаевна

Хорошо, София, давайт  
е попробуем завтра  
записать интервью. Но  
я, если всё  
сложится, смогу  
только после 18 ч

Хорошо, тогда до  
связи!

Окей

ср, 25 марта, 18:19

София, я не могу  
сейчас  
говорить, перезвоню



SMS/MMS



**25.03**

**the date was set  
to March 27th**

**80**

Новое сообщение    Отменить

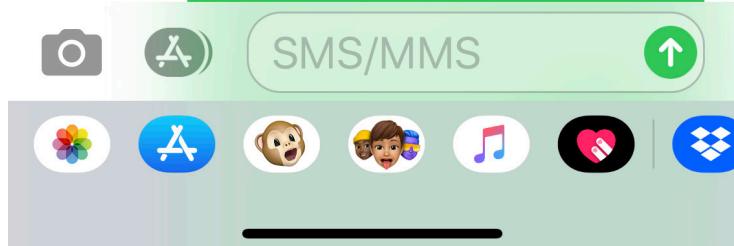
Кому: Ирина Николаевна

София, я не могу  
сейчас  
говорить, перезвоню

Хорошо

ср, 25 марта, 22:28

Ирина, добрый вечер!  
Не смогла до вас  
дозвониться, хотела  
вас спросить смогу ли  
я вас завтра записать  
на видео? Получила  
вашу запись, но она не  
читается у меня в  
программе. Мне очень



**27.03**

о обратно  
Суваже  
София

пт, 27 ма

**82** София, добрый

ДИ СВЯЗИ!  
енiem,

the date was set  
to March 30th  
рта, 19:56

вечер!

83

30.02

quaran

84

ntine

85



**After postponing the filming  
of the interview, I did not quite  
understand what I would  
do. I was already thinking  
of abandoning the idea of a  
documentary, but fortunately  
Irina Nikolaevna sent me audio  
and video materials that she  
managed to film and record  
before the museum of music  
closed.**

2

88

# research

90

films



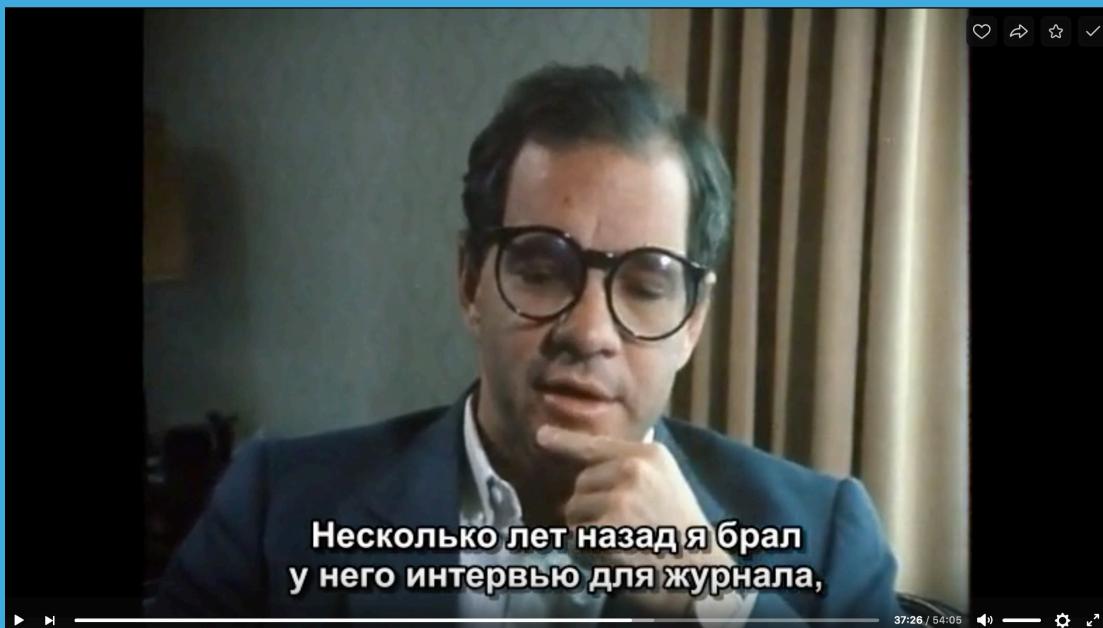
# by structure and format

# The Way to Bresson



Bresson is one of my favorite directors. The Way of Bresson is a documentary that tells not so much about the biographical facts of Bresson (of which not so many are known), but about those concepts and images through which you can enter the world of Bresson.

Jurien Rood and Leo de Boer,  
1984



Bresson is a moralist who is primarily interested in the moral choice of his heroes. He is a formalist who builds each frame with scrupulousness, which the viewer will never guess later. Bresson - author of transcendental cinema



# The Way to Bresson



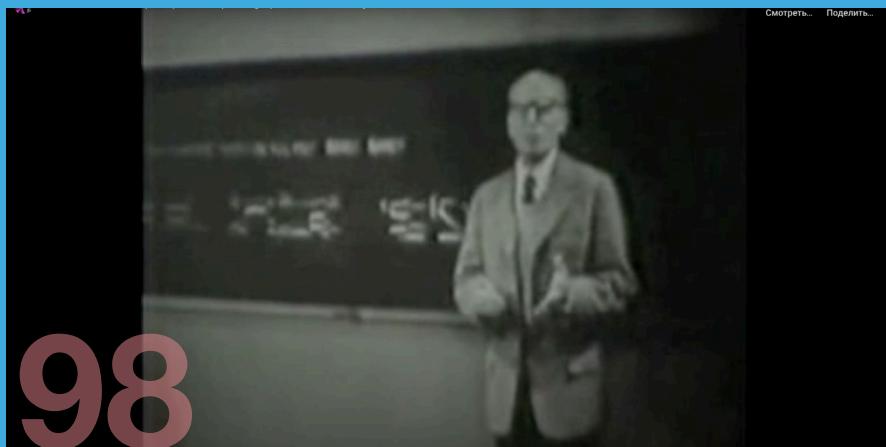
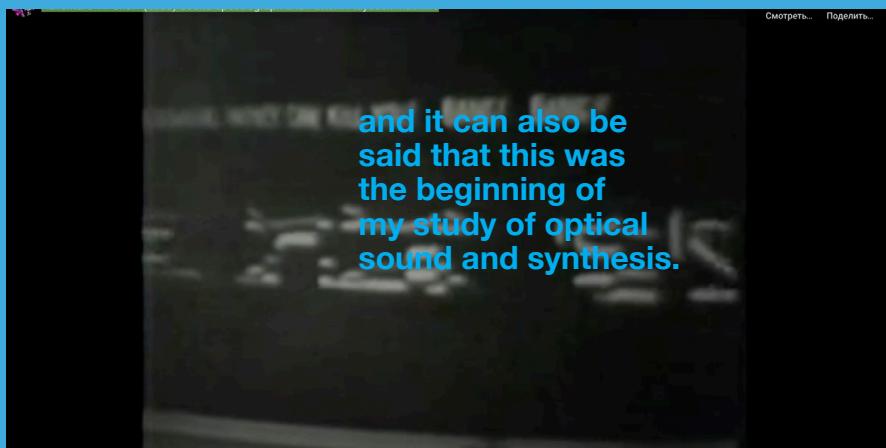
96

besides that documentary about Bresson was very interesting. I was interested in the structure of this documentary film, a certain sequence, ideology and how archival materials are used.

Jurien Rood and Leo de Boer,  
1984

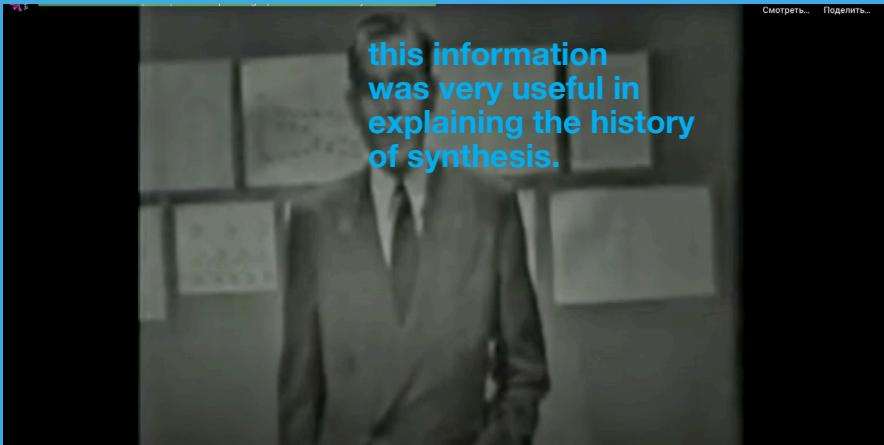


# Sound Spectrograph and Pattern Playback Machine



This film inspired me with its format, this film is made in the form of a television show. It also partially influenced on the structure of my film. At first I thought to make my film in the same format, to break all the parts of the film into separate episodes that cover the theme of graphic sound: one instrument - one episode 20-30 min. But for this, more material was needed and at that time I only had audio recordings from a museum employee and my archival materials.

# Adventure TV Show, 1953



In 1946, an acoustic spectrograph was invented. And the idea came up - to use spectrograms to control speech synthesizers. One of the first to introduce such a device was L. Schott, an American engineer at Bell Labs. He used a linear light source, translucent spectrographic patterns with varying degrees of transparency. Special photocells mounted opposite the lamp recorded changes in the level of illumination and generated control signals for bandpass filters. Homer Dudley used the exact same filters for his VODER.

# La Société du spectacle

I like that the video sequence is related to thoughts.

Если рассматривать спектакль через  
призму его собственного  
о себе мнения,



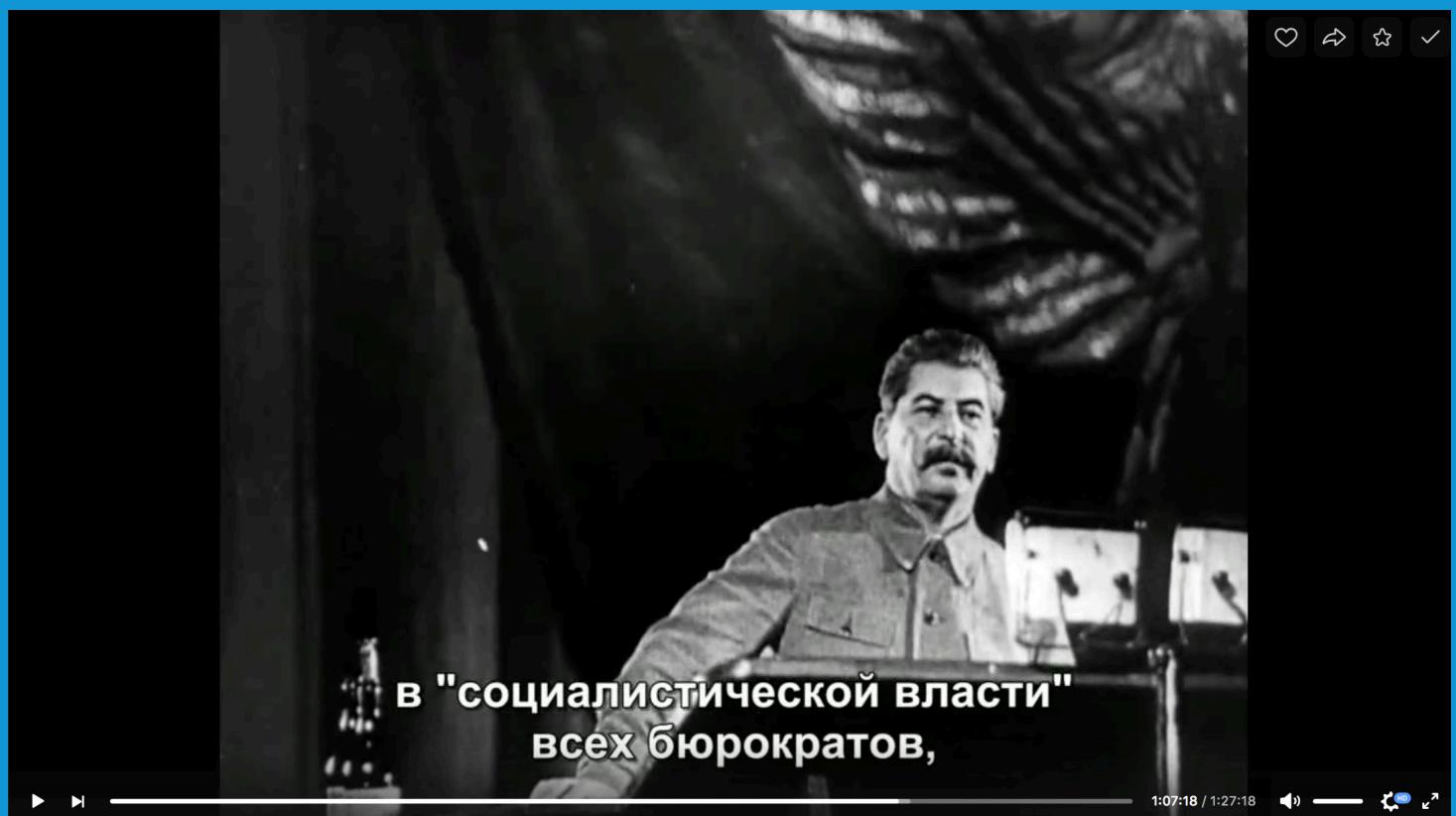
100



Guy-Ernest Debord

Guy-Ernest Debord,  
1967

The film reveals the ideas of consumerism, production, consumption and their impact on everyday life.



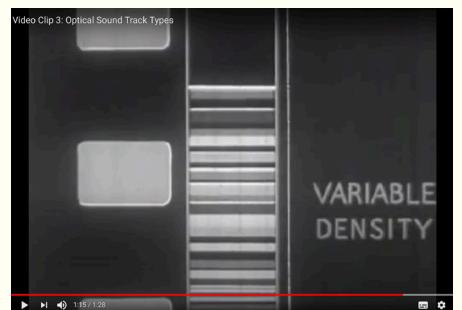
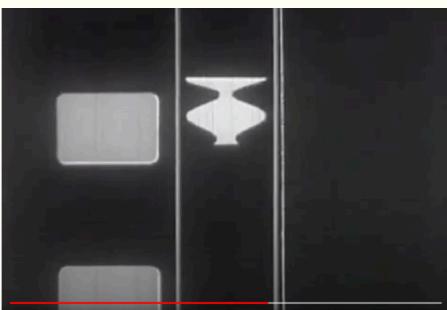
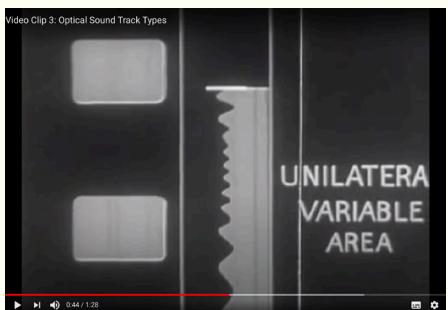
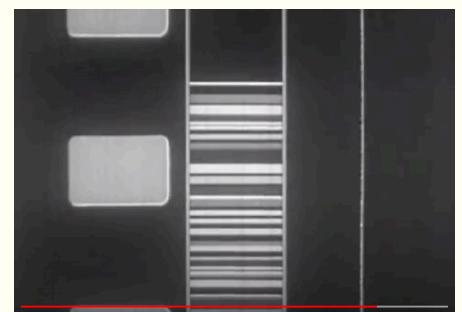
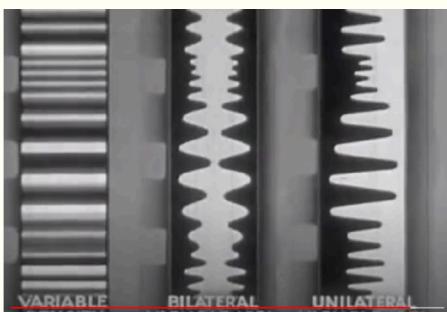
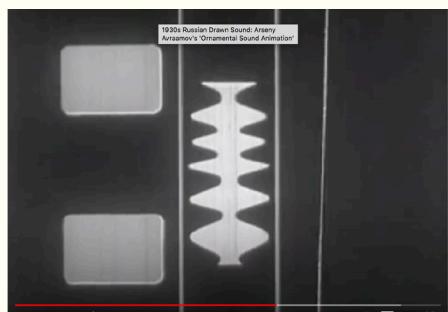
For me, Guy Debord  
is primarily an artist.

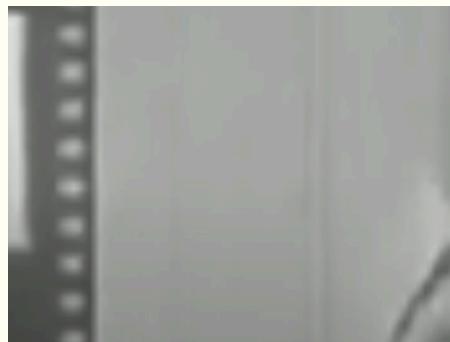
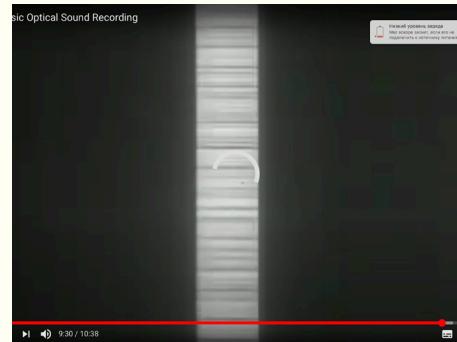
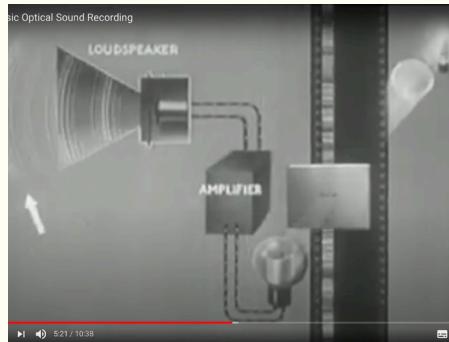
102

by context

# Optical Sound Track Types

It's surprising that an optical sound recorder in the vein of a reel-to-reel tape deck was never mass-produced.

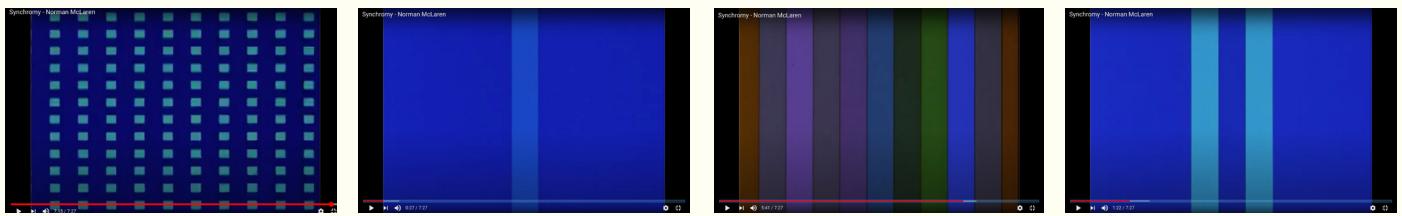




This is a 1943 film production explaining how optical sound was recorded for film. audio and video material was useful for research.

I began my research with the question: how was the sound of the film recorded before the appearance of magnetic tape.

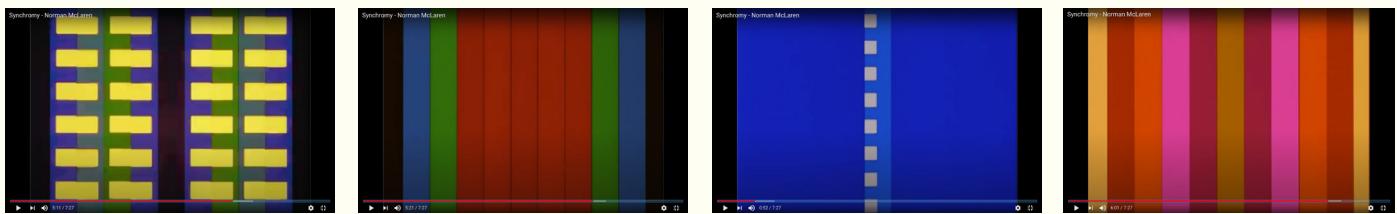
# Synchrony



106

This animated short by Norman McLaren features synchronization of image and sound in the truest sense of the word.

# Norman McLaren, 1971



To make this film, he employed optical techniques to compose the piano rhythms of the sound track, which he then moved, in multicolor, onto the picture area of the screen so that, in effect, you see what you hear.

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# Optical Synthesizer Oramics Machine



Daphne is Electronic Music Pioneer.

Daphne Oram,  
1960



She dreamed of a way to turn drawn shapes into sound, and she dedicated her life to realising that goal. Her Oramics machine anticipated the synthesiser by more than a decade.

With this machine she produced a number of internationally-performed works for the cinema, concert hall and theatre.

# Optical Synthesizer Oramics Machine



Daphne Oram was among the very first composers of electronic music in Britain and her legacy is the dominance of that sound world in our culture today.

Daphne Oram,  
1960



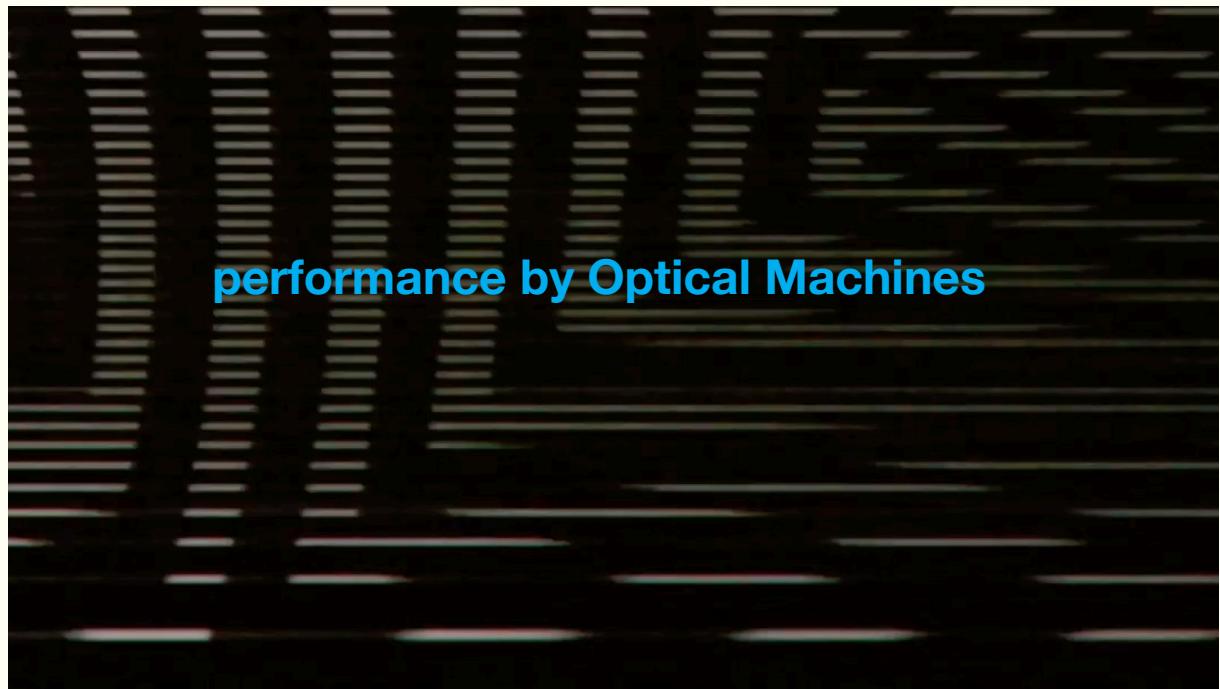
6:14

111



Optical Machines make a pure, authentic impression by combining their creations of sound (scapes) and visuals.

Optical Machines,  
2017



## performance by Optical Machines

In the performance they experiment with the deforming and deflecting of revolving image and sound. Creating an audiovisual environment to subside in the image works as a force of noise.

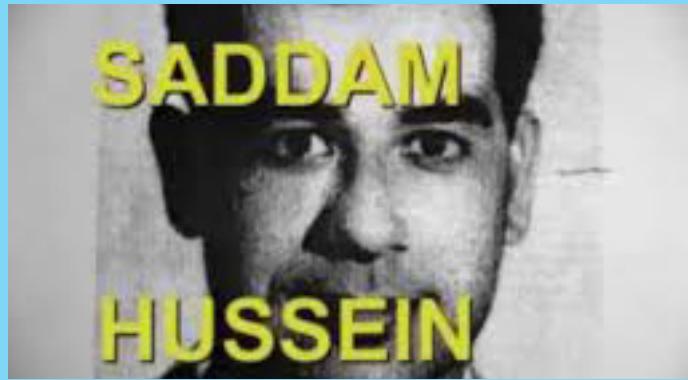
IT3



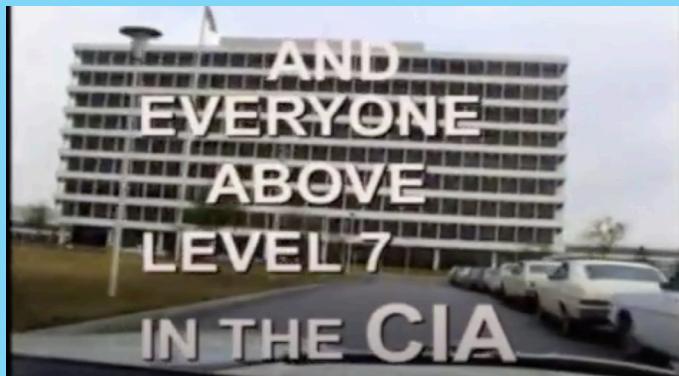
**by subtitles**

# It felt like a kiss

filmmaker's trademark is use of typography/text



Adam Curtis,  
2009



It felt like a kiss is documentary of Adam Curtis which working in a video essay format, explores America's rise to power after the 1950s through the use of archival materials, video clips, and pop music, these key elements have influenced visual and editing solutions of the film

# Histoire(s) du cinéma



One of the main works of Jean-Luc Godard, an eight-part essay film.

Jean-Luc Godard,  
1988-1998



archival materials and typography also  
influenced on visual and editing solutions of  
the film

# LE CINEMA



120



# books, journals, magazines

122



this is a list of references with books, articles  
and magazines that I initially used to write the  
script for the documentary

<b>Avraamov, Ars.</b>	“Sinteticheskaya muzika” Sovetskaya Muzika , No.8, pp. 67-75, 1939	<b>Levin, T.</b>	“Tones from out of Nowhere: Rudolf Pfenninger and the Archaeology of Synthetic Sound.” Grey Room 12, p. 32-79, 2003
<b>Balash, B.</b>	The art of cinema. M., p. 133, 1945		
<b>Egorova, T</b>	The Universe of Eduard Artemyev, 2006	<b>Music Publishing House</b>	Musical Life, Issues 7-12, 2014
<b>Galeev, B.</b>	Sovetskii Faust: Lev Termen, pioneer elektronnogo iskusstva, 1995	<b>Skorenko, T.</b>	Invented in the USSR: The History of Inventive Thought from 1917 to 1991, 2019
<b>“Gorn”</b>	Literature-artistic and social-scientific journal, 1923	<b>Solev, V.</b>	Absolute Music by Designed Sound. — American Cinematographer, p. 146-148, 154-155, 1936
<b>Izvestia Publishing House</b>	Culture and life, 1982	<b>Tsekhanovsky M.</b>	“O Zvukovoi Risovanno Filme.” Kino I Zhizn, Moscow. no. 34-35, p.14, 1930
<b>Izvolov, N</b>	The moment of revival of a sleeping idea. - “Kinovedcheskie zamentki”, No. 15, 1992	<b>Vishnevsky, V.</b>	25 years of the Soviet cinema. M., p. 52, 1945
<b>Journal</b>	«Radio Front» Drawn Sound, 1935	<b>Yankovsky, B.</b>	“Analiz i sintez tembra” (Analysis and Synthesis of Timbre) March, 1935, Moscow. Unpublished article. Theremin Centre Archive. p. 35, 1935
<b>Kaganovsky, L.</b>	The Voice of Technology: Soviet Cinema’s Transition to Sound, 1928–1935, 2008		

web

124

<b>ANS</b> the world's first studio music synthesizer <a href="http://www.tvkultura.ru/news.html?id=393864&amp;cid=178">http://www.tvkultura.ru/news.html?id=393864&amp;cid=178</a>	<b>Kobzev, D.</b> The technology of "drawn sound": sound synthesis in the USSR of the 30s of the XX century, <a href="https://habr.com/ru/post/182778/">https://habr.com/ru/post/182778/</a> , 2013	<b>Smirnov, A.</b> GRAPHICAL SOUND, <a href="https://asmir.info/graphical_sound.htm">https://asmir.info/graphical_sound.htm</a> , 2011	<b>Yankovsky, B.</b> Theory and practice of «graphic sound» - acoustic synthesis of musical colors, <a href="http://www.theremin.ru/archive/yankovsky2.htm">http://www.theremin.ru/archive/yankovsky2.htm</a>
<b>ANS</b> <a href="https://ru.wikipedia.org/wiki/АНС_(синтезатор)">https://ru.wikipedia.org/wiki/АНС_(синтезатор)</a>		<b>Smirnov, A.</b> Sound out of Paper, 2011	
<b>Ash, A.</b> The Adventures of the Revarsaurus <a href="http://blagaya.ru/put/articles/revarsavr/">http://blagaya.ru/put/articles/revarsavr/</a> , 2007 Авраамова	<b>Kornienko, M.</b> Arseny Avraamov - discoverer of new sound worlds, <a href="http://www.etheroneph.com/audiosophia/248-arsenij-avraamov-otkryvatel-novykh-zvukovikh-mirov.html">http://www.etheroneph.com/audiosophia/248-arsenij-avraamov-otkryvatel-novykh-zvukovikh-mirov.html</a>	<b>Theremin</b> <a href="https://ru.wiki-pedia.org/wiki/Термен,_Лев_Сергеевич">https://ru.wiki-pedia.org/wiki/Термен,_Лев_Сергеевич</a>	<b>Zolotov, A.</b> Hand-drawn sound: from the past to the future, <a href="https://xakep.ru/2014/10/17/cinema-voice-history/">https://xakep.ru/2014/10/17/cinema-voice-history/</a> , 2014
<b>Avraamov, A.</b> «Industrial Horns» <a href="http://www.theremin.ru/archive/gudkovaya.htm">http://www.theremin.ru/archive/gudkovaya.htm</a>	<b>Kreichi, S.</b> The ANS Synthesizer: Composing on a Photoelectronic Instrument <a href="http://www.theremin.ru/archive/ans.htm">http://www.theremin.ru/archive/ans.htm</a>	<b>Theremin</b> The forgotten «man of the future» <a href="http://izbrannoe.com/news/lyudi/lev-termen-zabytyy-chelovek-budushchego/">http://izbrannoe.com/news/lyudi/lev-termen-zabytyy-chelovek-budushchego/</a> , 2017	<b>Zolotov, A.</b> <a href="https://xakep.ru/2014/10/17/cinema-voice-history/">https://xakep.ru/2014/10/17/cinema-voice-history/</a>
<b>Gladilshchikova, A.</b> Music without musicians <a href="https://www.mn.ru/culture/85622">https://www.mn.ru/culture/85622</a> , 2013	<b>Nivotone</b> <a href="http://www.digitalmusicacademy.ru/lesson-nivoton">http://www.digitalmusicacademy.ru/lesson-nivoton</a>	<b>Variophone</b> <a href="http://www.theremin.ru/archive/variophone.htm">http://www.theremin.ru/archive/variophone.htm</a>	<a href="https://kommunikaru268121494.wordpress.com/2019/01/29/технология-рисованного-звука-синтезатора/">https://kommunikaru268121494.wordpress.com/2019/01/29/технология-рисованного-звука-синтезатора/</a> <a href="http://othermedia.info/?p=9891">http://othermedia.info/?p=9891</a> , 2017
<b>Izvolov, N.</b> <a href="https://echo.msk.ru/programs/sound-track/742738-echo/">https://echo.msk.ru/programs/sound-track/742738-echo/</a> , 2011	<b>Nivotone</b> <a href="http://theremin.ru/archive/nivoton.htm">http://theremin.ru/archive/nivoton.htm</a>	<b>Voinov, N.</b> <a href="https://ru.wiki-pedia.org/wiki/Воинов,_Николай_Васильевич">https://ru.wiki-pedia.org/wiki/Воинов,_Николай_Васильевич</a>	<a href="http://velikayakultura.ru/russkaya-muzika/muzyika-russkogo-avangarda-idei-avtoryi-nasledie">http://velikayakultura.ru/russkaya-muzika/muzyika-russkogo-avangarda-idei-avtoryi-nasledie</a> , 2015
<b>Izvolov, N.</b> <a href="http://www.kinozapiski.ru/ru/article/sendvalues/742/">http://www.kinozapiski.ru/ru/article/sendvalues/742/</a> , 2001	<b>Sholpo , E</b> <a href="https://ru.wikipedia.org/wiki/Шолпо,_Евгений_Александрович">https://ru.wikipedia.org/wiki/Шолпо,_Евгений_Александрович</a>	<b>Yankovsky, B.</b> «Vibro-exposer» <a href="http://www.digitalmusic-academy.ru/lesson-vibroexponator">http://www.digitalmusic-academy.ru/lesson-vibroexponator</a>	

3

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# prototypes



this is the part with the chronology, which I compiled using the information that I found from books and the Internet. this was the necessary part in the study, the chronology of the events related to the graphic sound helped me to plan the script for the film.

# chronology

Inventor Lev Theremin (1896- 1993) playing his thereminvox - first electronic musical instrument. Early 1920-s.

Lev Theremin at NKVD (KGB) prison after his return to Soviet Russia. 1939-1947

Building of Moscow "Sharashka" - special prison for scientists

Classical heterodyning type Theremin Circuitry

Lev Theremin's Great Seal Bug, "donated" to American Ambassador by Soviet "Pioneers" in 1945

Great Seal Bug construction – a sort of microwave theremin

Soviet radiolocation systems, capable to produce and detect directed microwave radiation in 1940-s

Commercial Laser- monitoring eavesdropping system, based on the same principle as Lev Theremin's "Buran" system built in 1947

The poster of Lev Theremin's lecture- concert (1920-s), where he presented different technical possibilities to combine music and color, music and gesture, music and tactile senses, music and smells.

Lev Theremin's light instrument to control colored light during the performance, 1923.

Lev Theremin's TV system (Dalnovidenie), 1925, St.Petersburg/Moscow

Lev Theremin's automatic door opening system

Audio delay line, based on heating (1960-s)

Evgeny Sholpo working with his VARIOPHONE - device to produce artificial sound tracks.

Polyphonic sound track by Evgeny Sholpo, created on his VARIOPHON instrument in 1931-1934

Loading of the variophone disk into the optical system

Painted polyphonic soundtrack 1929

Nikolay Voinov working with his paper-sound technique (1931-1933)

Nikolay Voinov's NIVOTONE instrument

Inventor Evgeny Murzin and ANS Synthesizer (development started in 1936, finished in 1958, Moscow)

Big version of the ANS Synthesizer (1962)  
720 sine oscillators 72 steps/octav Graphical score

Composers, working with ANS synthesizer in 1968

The operation principle of electro-optical ANS Synthesizer

ANS Optical disc - oscillator (144 sine sound tracks) and example of the graphical score - sonogram

Composer Stanislav Kreich working with ANS, late 1990-s, Moscow

The document of the State Committee for Radio- electronics and Ministry of Culture, 1962. Special commission of experts, including Lev Theremin, Andrei Volodiv, Evgeny Murzin etc. make a decision to support further development of ANS synthesizer.

Boris Yankovsky soundtracks, created on his VIBROEXPONATOR in 1931-1936

Basic principles of the Vibroexponator operation

Explanation of the additive synthesis and resynthesis of the syntones

Boris Yankovsky explanations of the additive and formant synthesis, 1932-1936, Moscow

Boris Yankovsky soundtracks of violin and speech sounds

Boris Yankovsky synthesis of speech sounds and sounds of brass wind instruments

Boris Yankovsky explanation syntones - spectral mutations from early 1930-s

Composer Aeseny Avraamov

Ultrachromatic music - 96 (48) steps per octave

One key of the Bow-Polyphonic (1916) The instrument for Ultrachromatic Music (the kind of microtonal music) 48 steps/octave

Symphony of Sirens 1921-1923 Bacu / Moscow

Symphony of Sirens, part of the score

The beginning of the Symphony of Sirens.

The basic setup of Moscow performance of Avrahamov's Symphony of Factory Sirens (1921-1923)

Arseny Avrahamov conducting his Symphony of Sirens, Moscow 1923

"Shorinophone" - device to produce sound films, late 1920's, Russia

First painted soundtracks by Arseny Avrahamov 1930-1931



This is chronology with Yankovsky and Avraamov; I did not include their inventions in the documentary. But they are also inextricably linked with the theme of graphic sound.



# scenario



**НИВОТОН**

Недоста...но места



**script**

Недоста...но места



**text**

Недоста...но места



**text for posts**

Недоста...но места



**1 part of the text**

Недоста...но места



**Sonia TEXT**

Недоста...но места



**draft**

Недоста...но места



**text f**

Недоста...но места



**text f2**

Недоста...но места



for two parts: ANS  
and Theremin  
I transcribed the  
text from the audio  
recordings that Irina  
sent me, and for the  
parts: Variophone  
and Nivotone, I wrote  
the text myself based  
on the articles, texts  
and chronology of  
events related to  
inventors

at the initial stage of the creation process I had 2 videos from the archive and 6 videos from YouTube. Later there I've got 3 videos from Irina Nikolaevna, which she managed to record and sent to me before the museum was closed



sholpo and  
illustrations.mpg  
Недоста...но места



ans irina.mp4  
Недоста...но места



theremin  
irina.mp4  
Недоста...но места



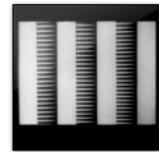
sholpo .mp4  
Недоста...но места



sholo2.mp4  
Недоста...но места



voinov thief.mp4  
Недоста...но места



voinov .mp4  
Недоста...но места



терменвокс.mp4  
↑ 3,8 МБ

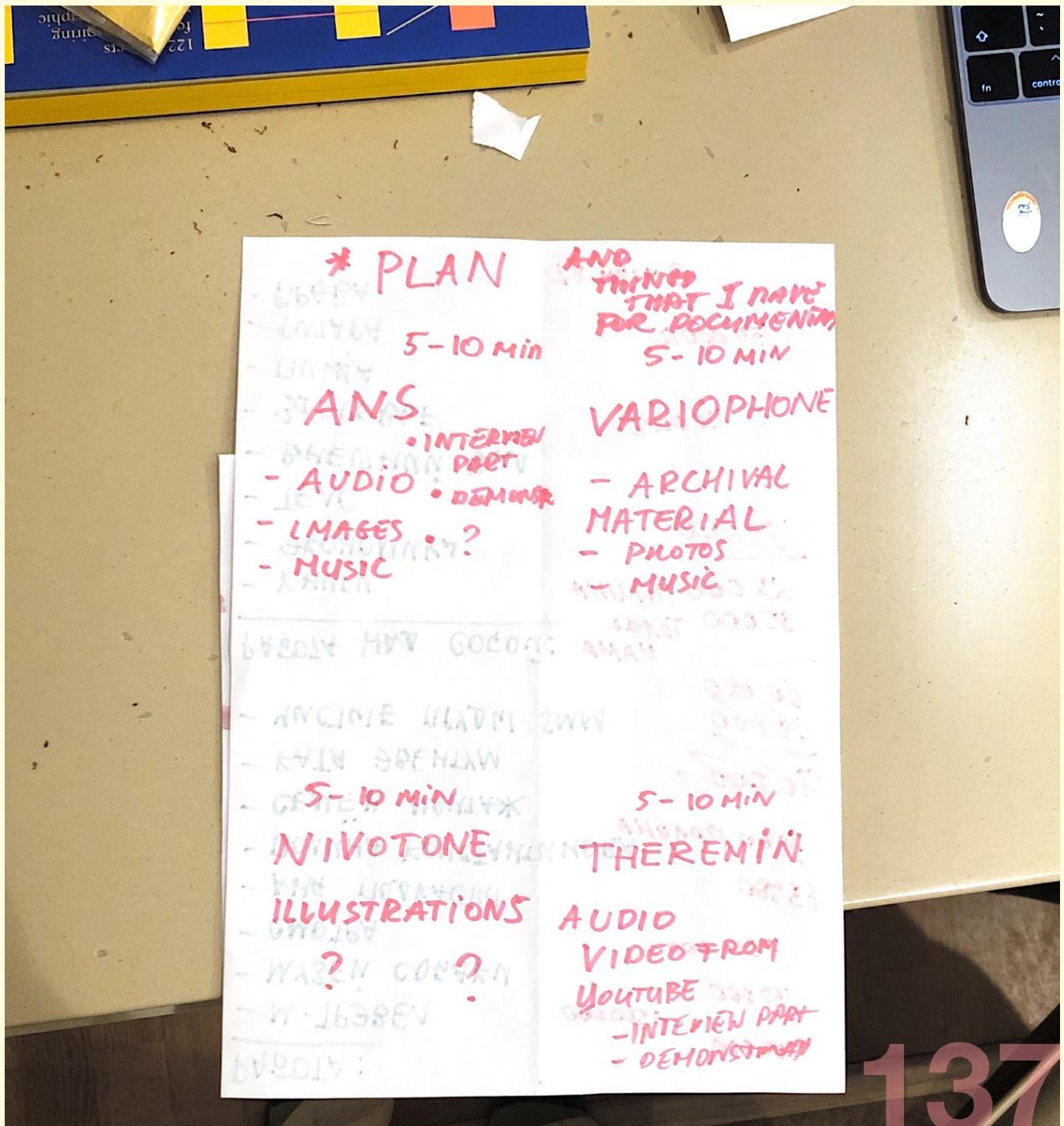


00002 (1).mp4  
↑ 112,8 МБ



kreichi.mp4  
↑ 25,5 МБ

the plan for the documentary at the initial stage, since I didn't have video materials until a certain time, I had to make a plan from the materials that I had. I divided the film into 4 parts. The idea was in a definite sequence from the very last invention of graphic sound to the earliest inventions.



# script

## Part 1

### The Ans synthesizer.

One of the most unusual instruments in the museum collection of the Russian National Museum of Music is the world's first photoelectronic synthesizer.

The Ans synthesizer or as it is called ANS. It is named in honor of Alexander Nikolayevich Scriabin - the great Russian composer whose admirer was the creator of this synthesizer engineer Evgeny Murzin. The history of the synthesizer is inextricably linked with the history of graphical sound in our country. As it is well known old movies were silent and In the 30s, sound came to the cinema. Because the soundtrack appeared on the film, which was drawn. And with it came the idea of drawn sound, the graphical sound of synthesis.

### The principle of Ans.

The principle of the synthesizer ans is connected with the idea of synthesized sound. The glass is covered with black mastic paint. Dots or lines or strokes that will be sounding notes are applied to it. The wheel is spinning, the glass goes into the slot, and inside is a reader. Light is directed to the image and the lens system is converted into an electric and then into an audio signal, and then you can hear the unusual sound of this instrument. Any piece of music can be translated into a graphic drawing, and any drawing can be voiced.

What is unique about the synthesizer invented by Murzin? If we have 12 semitones in the piano in the octave, then the ANS synthesizer has 6 gradations in each semitone, if we multiply 12 by 6, we will get 72 sounds in only one octave, and there are 10 of them, a whole treasury of sounds. The ANS can extract a variety of sounds, it can imitate any timbre, the sound of a voice, but it especially extract out the sounds of space and the music of space. The music of the Stalker and Solaris was created by Eduard Artemyev precisely with this synthesizer.

In the 60s of the last century, the Moscow experimental electronic music studio was created, which included composers Dison Denisov and Alfred Schnittke and Sofia Gubaidulina and Oleg Buloshkin and Alexander Nefti. And especially, Eduard Artemyev and Stanislav Kreichi worked closely with the inventor.

## Part 2.

### The Variophone.

Evgeny Aleksandrovich Sholpo - Soviet inventor, musician and art critic. In 1917, Sholpo wrote a science fiction story "The Enemy of Music", in which he described the "mechanical orchestra" - a machine capable of independently performing complex musical compositions.

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Then together with Arseny Avraamov in Petrograd, created the group named "Society of Leonardo da Vinci. « Members of the society discussed device designs that made possible to create and play music without the participation of live musicians.

In 1931, E.A. Sholpo constructed the first model of his "Variophone". A transmission was added to the camera, transmitting the rotation of the electric motor to the mechanism that stretches the film to the acoustic schedule. The animation machine is not used, filming is carried out on a moving film. A variophone allows a change in speed, i.e. pitch. The sound is rationalized by using 360 ° rotating discs with prongs.

Due to Sholpo, it became possible to get glissandos, vibrations of tone, shades, changes in sound strength.

### Captions for illustrations

Give the image of various figures on the «sound track» of the film. These images passing through a sound projector turn into sound. Thus, the Variophone is a purely optical device that not perceiving and not making any sounds. The resulting sound in the speaker at the screen made artificially without the participation of noise musical instruments. This is a (drawn) graphic sound.

### Part 3.

#### Nivotone.

Cinematographer Nicolay Voinov is also closely associated with the history of graphical sound. In 1930, he collaborated with Arseny Avraamov on projects connected to hand-drawn sound tracks. In 1931, he began his own research in the field of paper sound, based on the synthesis of sound tracks. Since 1931, Voinov has been a member of the IVOS group (Ivanov, Voinov, Sazonov), they created a number of animated films with synthetic soundtracks: "Barinya" (1931), "Rachmaninov's Prelude" (1932), "Crow's Dance" (1933), "Colored Fields and Security Lines" (1934), "Thief" (1934). With the help of Nivoton, it was possible to get a clear and clear sound.

Until the end of his life, he worked as an cinematographer of Soyuzmultfilm studio.

Unfortunately, in the official biography of Voinov, his experimental works of the 30s are practically not mentioned.

Voinov's system is very practical: according to his method, a clear sound is obtained. Voinov showed a graphic performance of the plays "The Musical Moment" by Schubert and "The Prelude" by Rachmaninov".

#### The principle of Nivotone.

The artist Voinov among several other people is working on the problem of artificial sound. He makes sounds from the paper. Silent characters will sound. The preparation is complete. A whole paper orchestra moves to animation stand. To right drawn characters to the left drawn sound. For his work, Voinov made blanks of 87 drawings, corresponding to all the tones of the piano, i.e., within the twelve-stage tempered system.

Pitch is determined in this system by the magnitude of the figures and their frequency. The lower the tone, the larger and wider the standard shapes are placed. All blanks are made of the same size 30X40 cm.

The strength of sound depends on the height and shape of the figures. The strongest sound

# script

is obtained when the prong occupies the entire transverse value of the phonogram; lowering the workpiece down, we get a weaker sonority. For a very quiet sound (pianissimo), the prongs should occupy 5 mm in the workpiece.

The tempo is set according to the metronome and depends on the number of frames in the drawing of a given tone per metric unit, for example: 48 frames per quarter note - a slow pace, 12-16 - fast. Rhythmic figures (ratio of durations) are established in the same way of establishing the relative length of a given phonogram. For example, if 64 frames are given for a half note, then 32 for a quarter note.

The timbre side of the sound is the most vulnerable side of this system. Due to the clear dissection of tones, their contrast, as well as the ability to give their attenuation. The music recorded by Voinov seems to be performed on the piano.

## Part 4.

### Theremin.

In Russia, the world's first musical instrument was invented. So Russia can rightfully be considered the birthplace of electro-acoustic music. The inventor of the first electric musical instrument was Lev Sergeyevich Theremin, an outstanding musician physicist.

The name of the instrument itself is connected with the name of the inventor - TERMEN. The uniqueness of this instrument is that the musician plays without touching his hands on the antennas.

### The principle of Theremin.

The right vertical antenna is responsible for the pitch, the left horizontal loop-shaped lamp is responsible for the dynamics of sound.

### Translation of a fragment from YouTube.

The theremin is the first instrument of this type. This is a song-voice instrument.

In it, control of the melody is achieved by influencing the electromagnetic field near the instrument.

The fate of this outstanding inventor is a surprise is astonishing.

Lev Termen graduated with a silver medal in St. Petersburg from the first male gymnasium, and also graduated from the Conservatory in the class of Cello. In parallel, he studied in a Petersburg at once in two faculties in the physical and astronomical.

In 1919, after the revolution, he was invited by the head of the laboratory to his physico-technical institute by Abraam Joffe, In this year Lev Theremin invented the first electro-musical instrument that glorified his name. An interesting meeting was with Theremin and Lenin, which took place in 1922. He explained the principle of Theremin and they together performed "Shylark" by Glinka. In 1927, Lev Theremin received an invitation to participate at the international conference on physical electronics in Frankfurt am Main, where he gave a talk about his invention and from that moment his name became truly world famous.

In 1928, Theremin went to the United States of America, where he lived for 10 years

remaining a citizen of the Soviet Union. He rented a studio and patented his inventions. His studio visited musicians and not only musicians such as George Heroin and Yasha Heyvits and Maris Aravel and financial tycoon John Rockefeller and even the future president of America Dwight Eisinhower.

Then Theremin returned to the Soviet Union. In the 60s he taught at the Moscow Conservatory, read lectures and lived for almost a century.

In addition to Theremin, he became the inventor of the automatic doors, burglar alarms and even one of the first television vision systems, a distant ancestor of modern television.

### **Conclusion.**

ANS, Variophone, Nivotone, Theremin are the origins of electronic music.

Now these inventions and their sound are forgotten. But they served as the basis for development and current status for areas such as Science, Music, Art and Cinematograph. This is the legacy and heritage of the Soviet Union. Which we should know and remember. This film is not only a coverage of the theme of graphical sound, but also a tribute to the memory of Soviet inventors and their contribution.

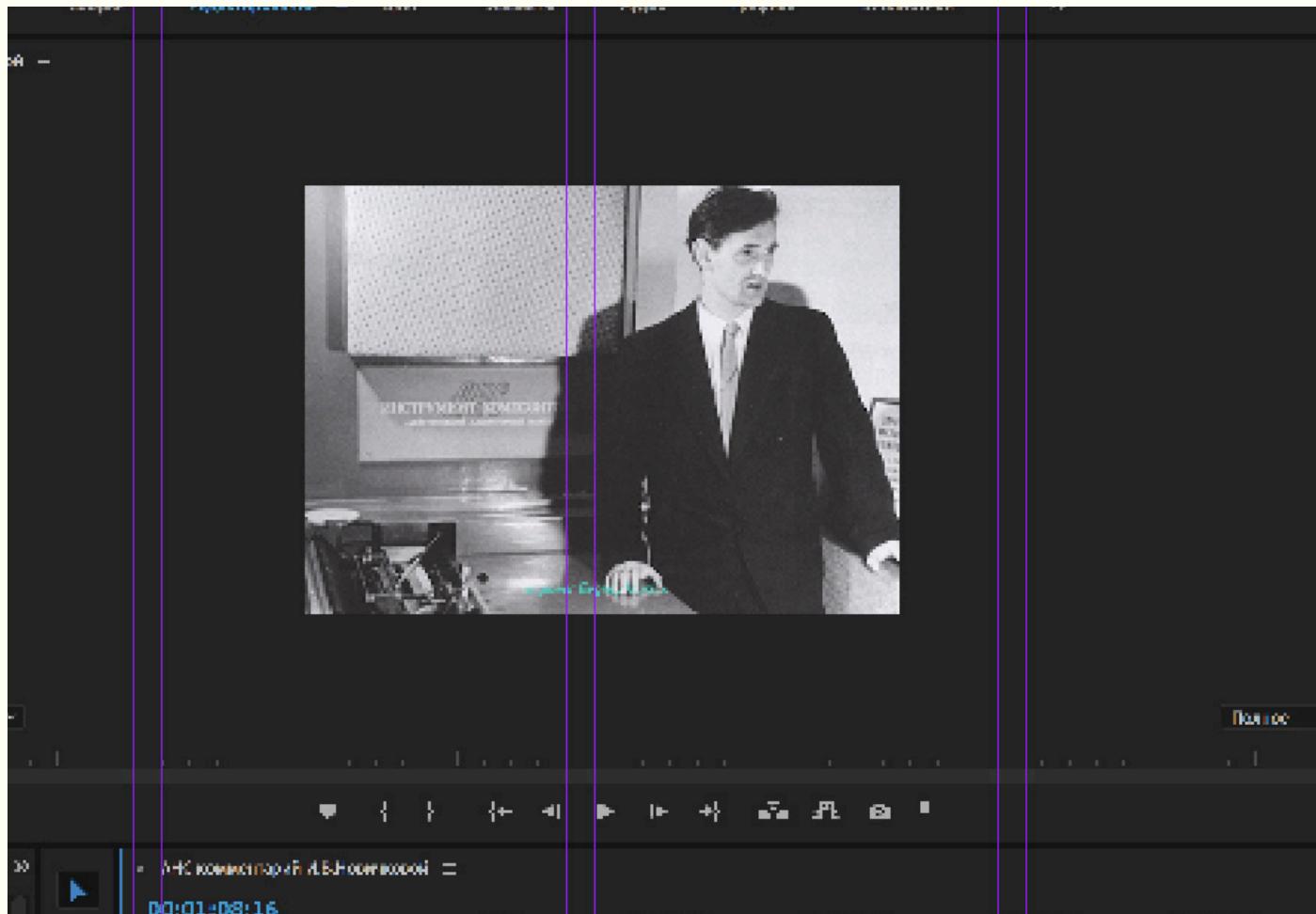
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**drafts**

**143**



it was the very first draft of the film. all the subtitles were blue, at that time I didn't have any video material, so I found a video in YouTube with another museum employee, where she explains the principle of the ans sintesizer.



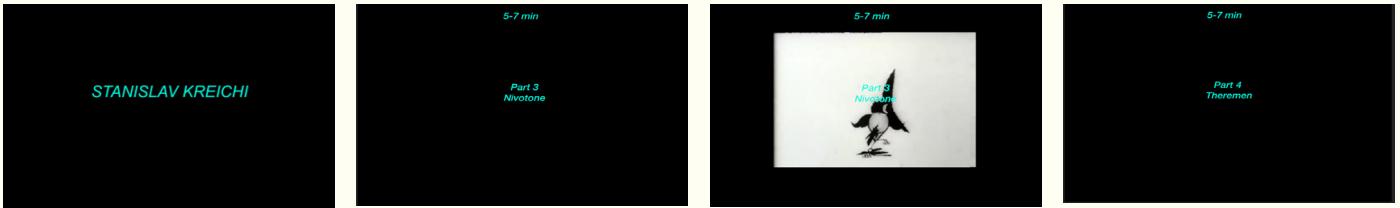
the text looked boring, and at that moment I only had 5 minutes plan, instead of parts with an interview there was a black background and approximate time, at that time I did not quite understand how I could put all the material together.

# draft #1



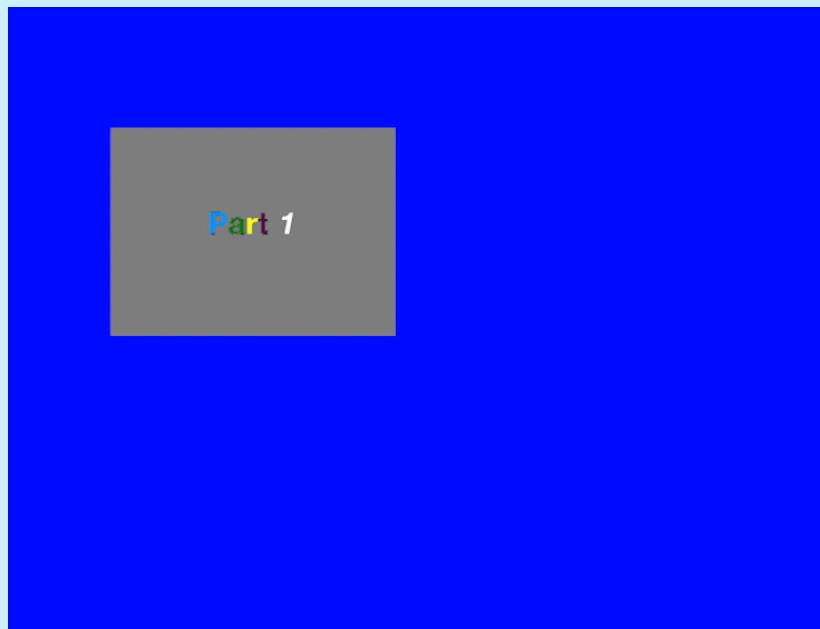
visuals - subtitles in the first draft  
were influenced by Adam Curtis's film  
“Hypernormality”

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it didn't reflect the topic, I didn't understand what decisions I could make to solve the problem with visuals.

## draft #2

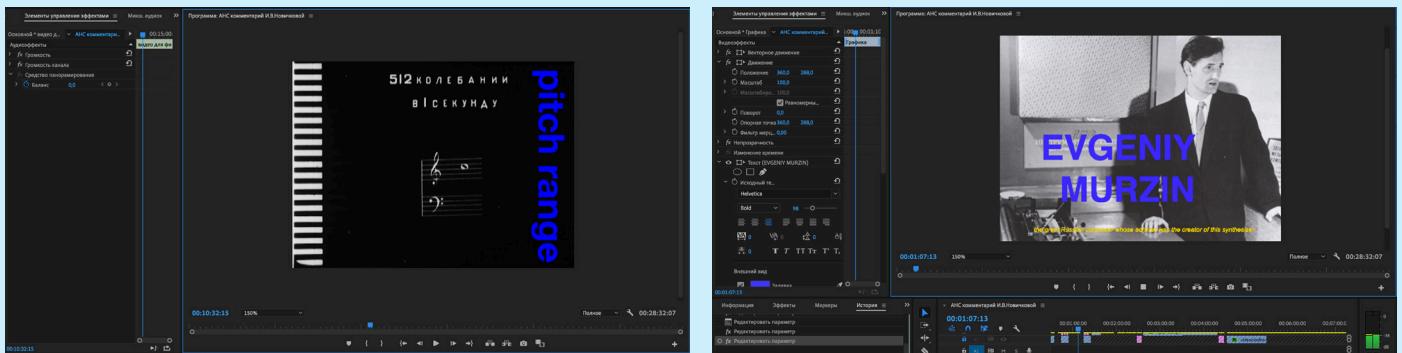


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for the second draft, I already had a video from Irina, so the film slowly began to assemble. the second draft was strongly influenced by the visuals of the film It like a kiss, at that time I realized that I would use 4 colors that will divide the chapters, one chapter one color.



# draft #2



for the most part I worked with captions, and the subtitles were the same, at that time there was still no clear system for subtitles and captions.

**DRAWN  
SOUNDTRACK  
ON FILM**

Because the soundtrack appeared on the film

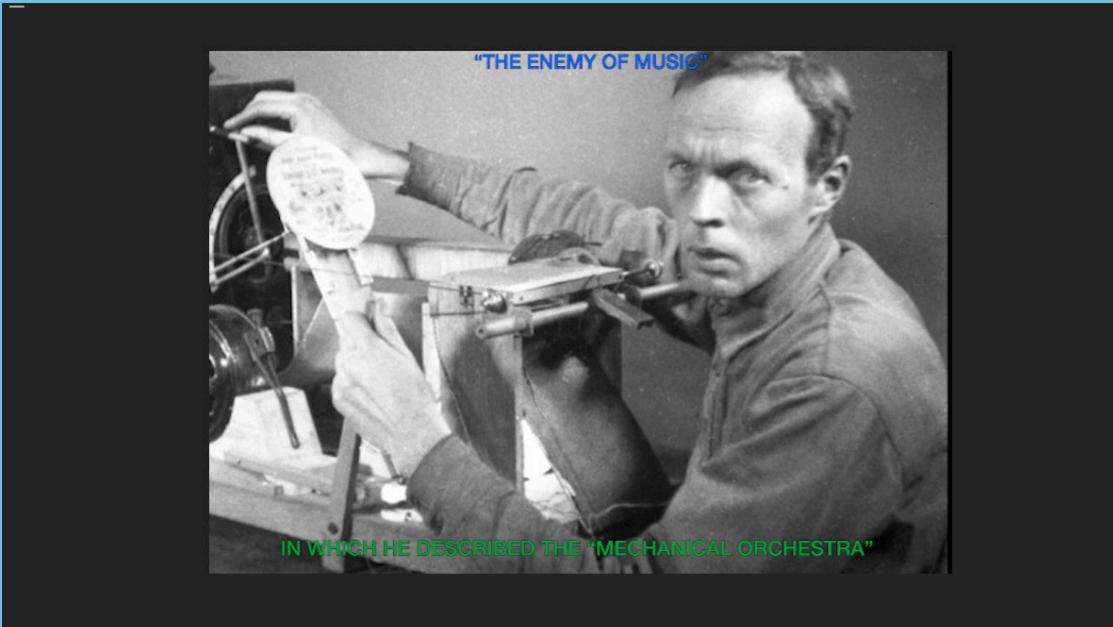
**EVGENIY  
MURZIN**

*the great Russian composer whose admirer was the creator of this synthesizer*

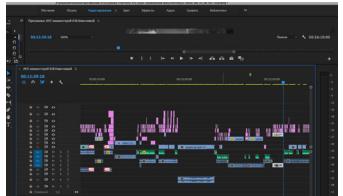


by the third draft, i've got all parts: archival materials, videos and audios from irina, and structure. a sequence was determined, the film structure was in sequence from the last invention of graphic sound to the very first electro-acoustic invention of Lev Thermen.



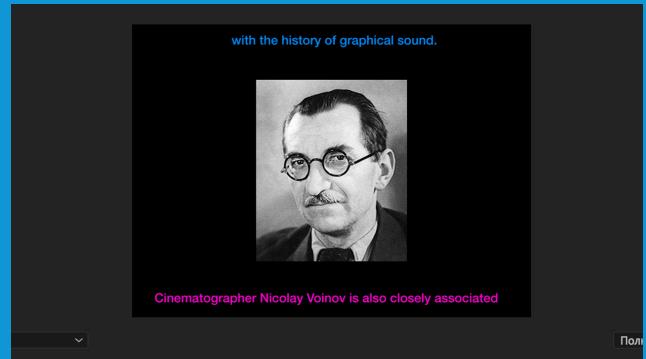
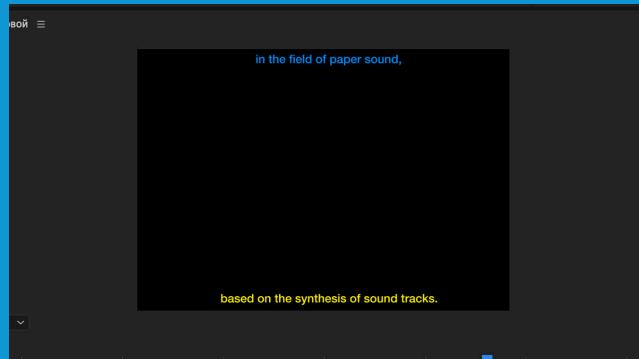


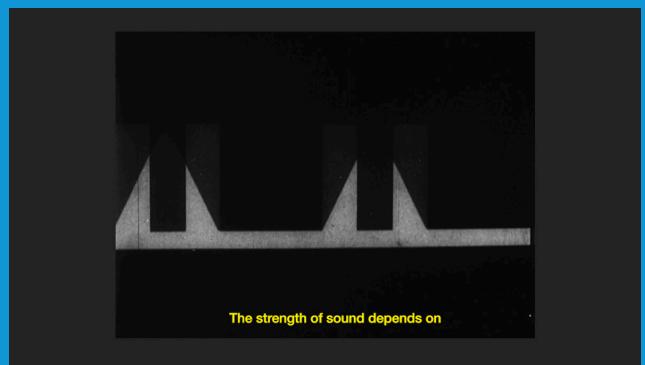
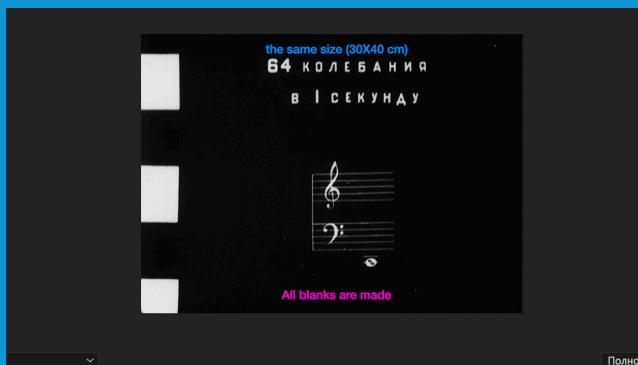
subtitles went both horizontally and vertically, in sequence from bottom to top, clockwise. vertical subtitles were hard to read.



the logic of the subtitles was inspired by Shoplo's spinning discs, but unfortunately this solution did not work because much attention was directed to reading subtitles.

# draft #4



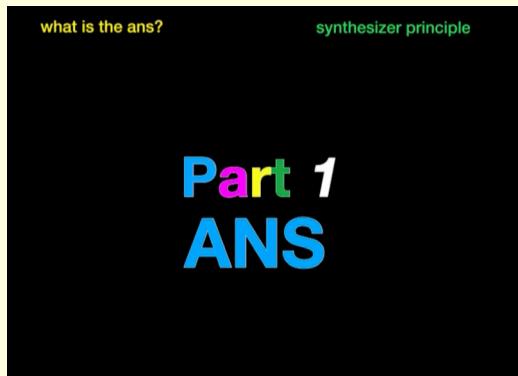


I realized that the vertical subtitles don't work,  
I decided to do it only horizontally, it  
became easier to read, but I wanted to leave  
the ordered logic as in previous draft

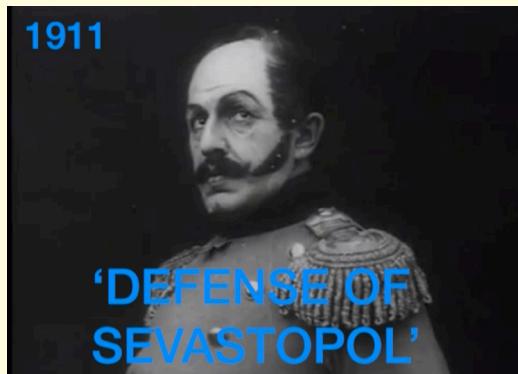
# 4

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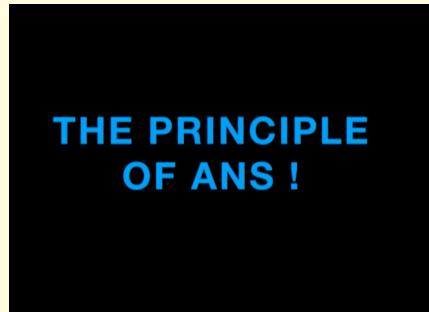




the first part is devoted to the **ans synthesizer** of evgeny murzin, which includes the videos about this **synthesizer** recorded by Irina Novichkova, its operating principle, fragments of films that are connected with this **synthesizer**. The music that is present in this part is also written on this **synthesizer**.



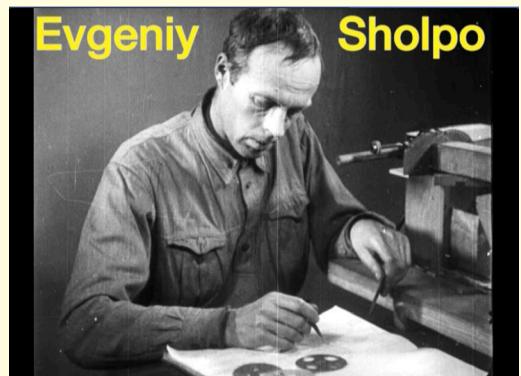
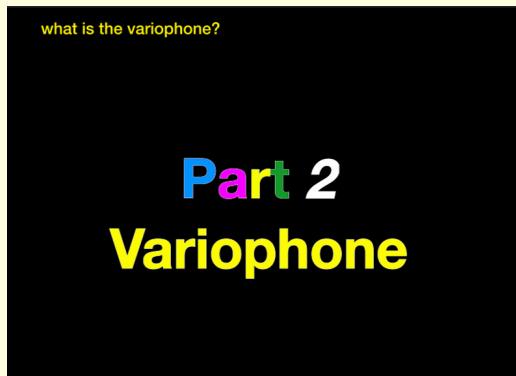
**final**

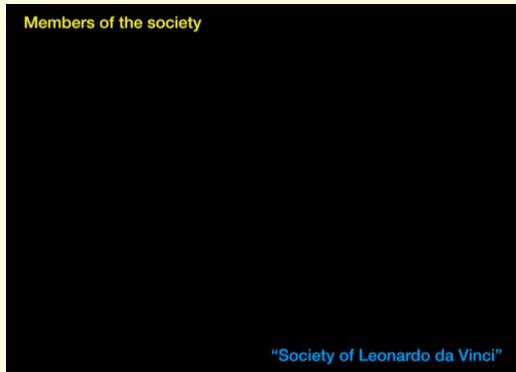
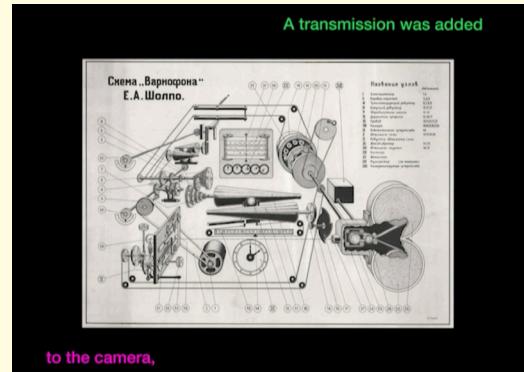


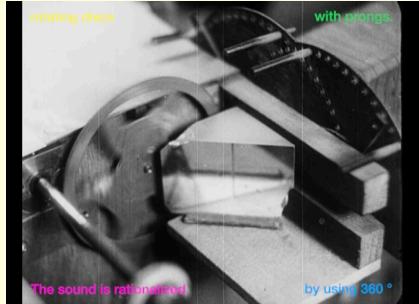
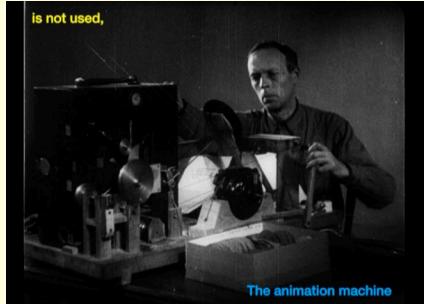
**162**



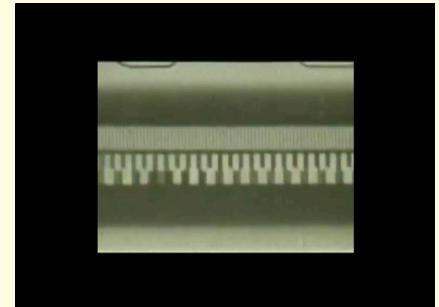
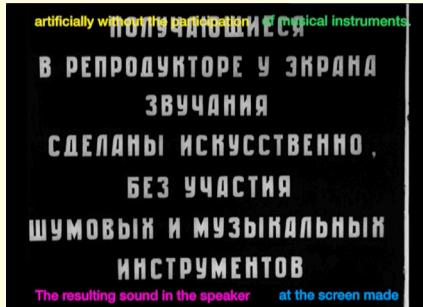
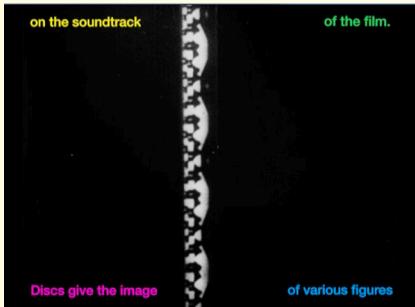
captions in this part : names, years, names of compositions, names of films are in **blue** and have the same sequence logic as subtitles



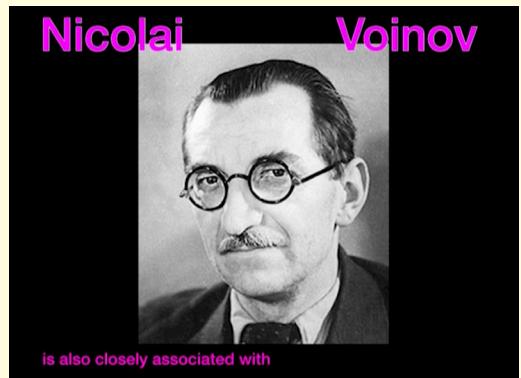


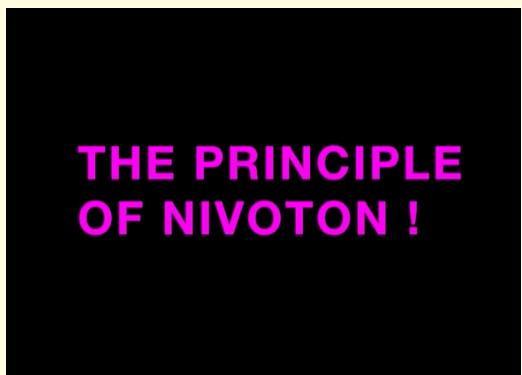


in this part I recorded the voice of my friend Anton Grebentsov, since I did not have material from the museum employee. I wrote the whole text myself based on articles and archival materials.

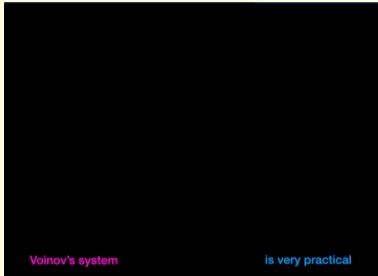


captions in this part : names, years, names of compositions are in yellow and have the same sequence logic as subtitles.





# final



is very practical

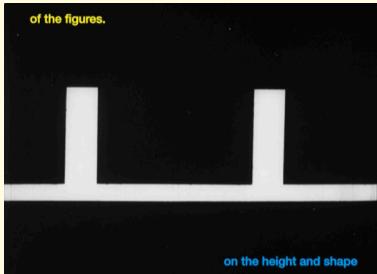


to the left drawn sound.



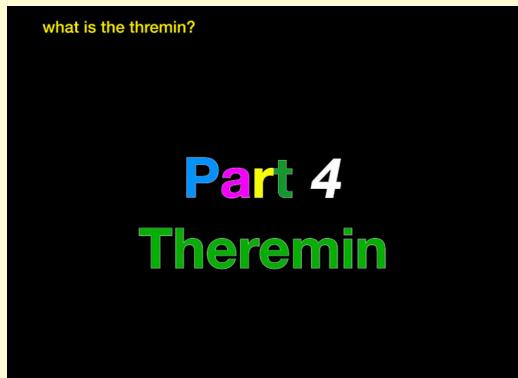
among several other people



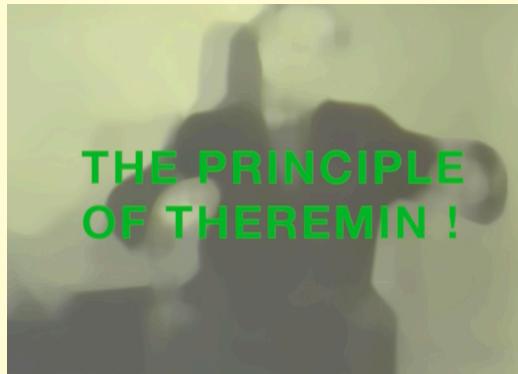


captions in this part : names, years, names of compositions are in magenta and have the same sequence logic as subtitles.

final



the fourth part is dedicated to Theremin's **Theremin**, this is the very first electro-acoustic instrument, it was with this invention that the history of graphic sound began. this part includes a part with Irina Novichkova, where she talks about their inventor, the principle of the instrument and she also demonstrates how this **Theremin** works, in addition to this, this part includes a demonstration of the **Theremin** of Lev Theremin himself. the music used in this part is recorded using **Theremin**



captions in this part : names, years, names of compositions are in green and have the same sequence logic as subtitles.

# final



the final part includes my conclusion, which I made during the research of this theme, the conclusion reflects the problems of this topic. To complete this film, I found a video where a musician performs modern electronic music playing the Theremin, and on synthesizer. This combination of the old invention and the new synthesizer suggests that times intersect.

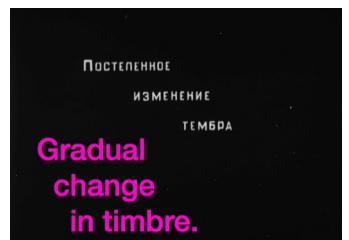
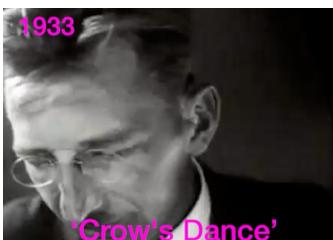
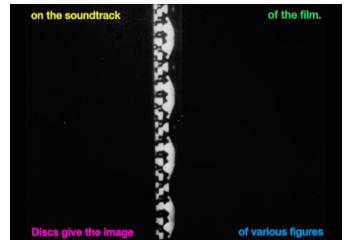
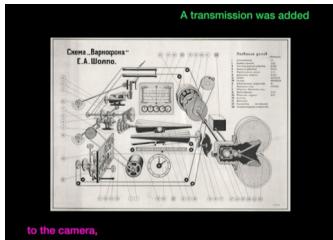
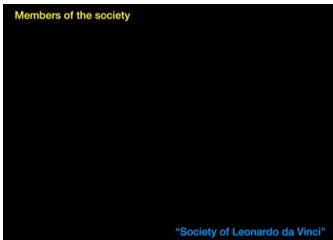


the Soviet inventors created musical instruments of the future. Their ideas about synthetic music, optical sound, influenced on the development of electronic music.

Therefore, it can be said that without their inventions electronic music would hardly be what it is now.

# final

<p>what is the ans?</p> <p><b>Part 1</b> <b>ANS</b></p> <p>synthesizer principle</p>	<p>Evgeniy Murzin</p>	<p>1911</p> <p>'DEFENSE OF SEVASTOPOL'</p>	<p>Russia's first</p> <p>full-length film</p>
<p>what is the variophone?</p> <p><b>Part 2</b> <b>Variophone</b></p>	<p>Evgeniy Sholpo</p>	<p>a machine capable</p> <p>of independently performing</p>	<p>Arseniy Avraamov</p>
<p>films</p> <p><b>Part 3</b> <b>Nivotone</b></p>	<p>Nicolai Voinov</p>	<p>Arseniy Avraamov</p> <p>on projects connected to</p>	<p>1932</p> <p>Rachmaninov's Prelude</p>
<p>what is the theremin?</p> <p><b>Part 4</b> <b>Theremin</b></p>	<p>Russia can rightfully be considered</p> <p>the birthplace</p>	<p>LEON THEREMIN</p> <p>an outstanding physicist and musician</p>	<p>Dwight Eisenhower</p> <p>President of America</p>
<p>1958</p> <p>Evgeniy Murzin</p> <p><b>final</b> <b>ANS</b></p>	<p>1931</p> <p>Evgeniy Sholpo</p> <p><b>final</b> <b>Variophone</b></p>	<p>1930</p> <p>Nicolai Voinov</p> <p><b>final</b> <b>Nivotone</b></p>	<p>1920</p> <p>Leon Theremin</p> <p><b>final</b> <b>Theremin</b></p>





**This is the end of the first part  
of the documentary making  
process.**

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# sounds experiments

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# introduction

# movie projector raduga



I wanted to bring the technique of graphic inventors to life, so I decided to repeat the simplified method of Norman McLaren, who used a sound optical film projector and an ordinary film, drawing points and lines on it. I found on Avito an old 1970 film projector Raduga for 16 mm film which weighs 20 kg



when I came to buy a projector I was met by an old grandfather, obviously a veteran, **Ivan Borisovich Kolesnikov**, he told me how this projector works because its operating principle is not quite simple, and also he showed his films so that I was convinced that **Raduga** works.

**raduga**



**186**



this is how this  
projector looks from  
the side.

**raduga**

КИНОУСТАНОВКА ПОРТАТИВНАЯ  
„РАДУГА“—

ТЕХНИЧЕСКОЕ ОПИСАНИЕ  
и ИНСТРУКЦИЯ ПО ЭКСПЛУАТАЦИИ

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## 1. НАЗНАЧЕНИЕ

1.1. Настоящее техническое описание распространяется на кинустановку портативную КП1 («Радуга»), предназначенную для демонстрирования черно-белых и цветных 16-миллиметровых звуковых кинофильмов с оптической или магнитной фонограммами в условиях непрофессиональной киносети.

## 2. ТЕХНИЧЕСКИЕ ДАННЫЕ

2.1. Питание кинопроектора и усилителя осуществляется переменным током частотой 50 гц напряжением 220 в.

Допустимые колебания напряжения сети, при которых обеспечивается нормальный режим работы кинопроектора — 185—230 в.

При колебаниях сети выше указанных пределов обязательно применение стандартного регулирующего трансформатора мощностью не менее 250 вт.

2.2. Потребляемая кинопроектором электрическая мощность — не более 220 вт.

2.3. Кинопроектор рассчитан на работу с бобинами емкостью 120 и 600 м фильма.

2.4. Электродвигатель кинопроектора — однофазный, асинхронный, конденсаторный типа АВЕ-042-2:

режим тока — переменный;

напряжение — 220 в;

частота — 50 гц;

число оборотов в минуту — 2700;

мощность на валу — 30 вт.

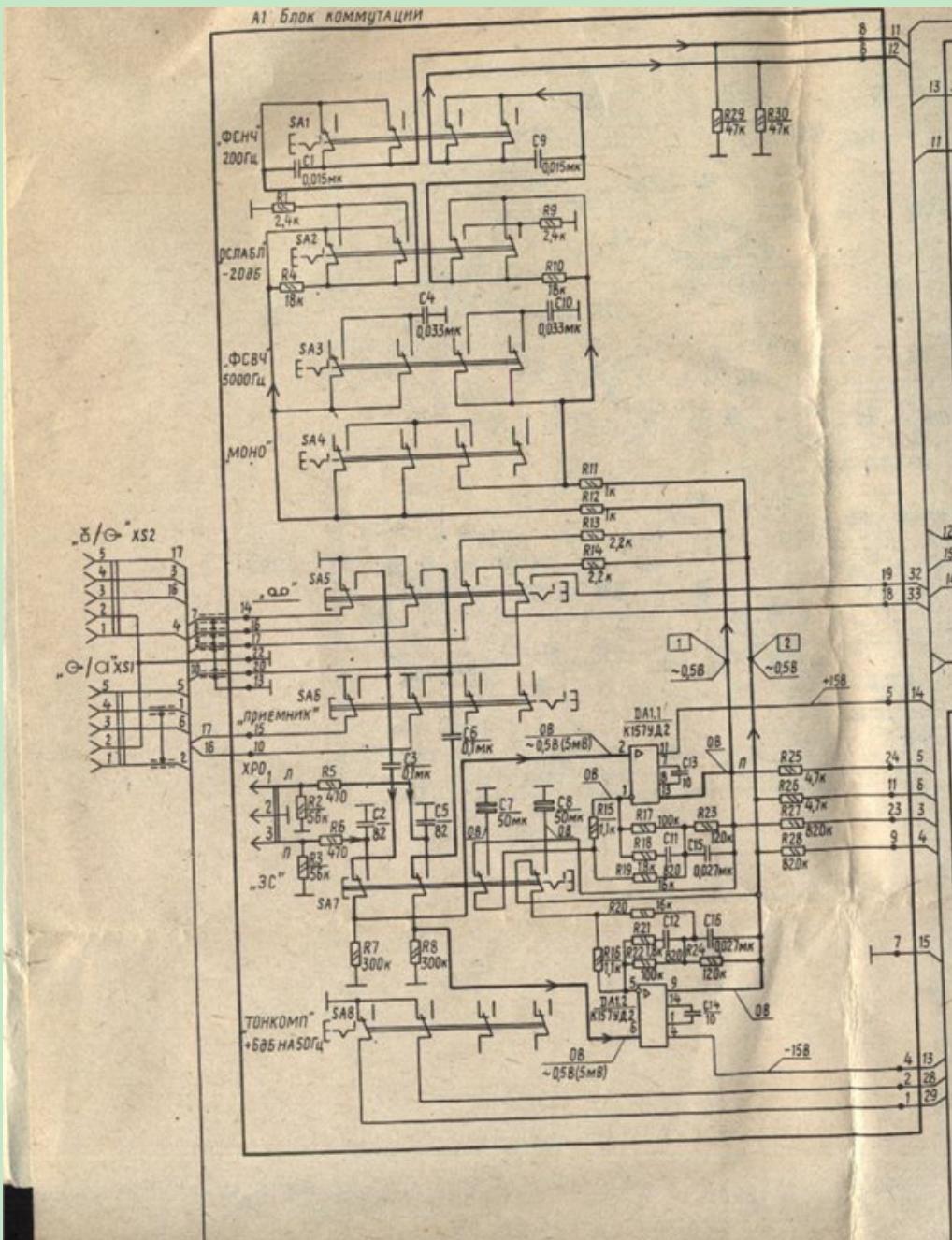
Емкость пускового конденсатора — 1 мкф.

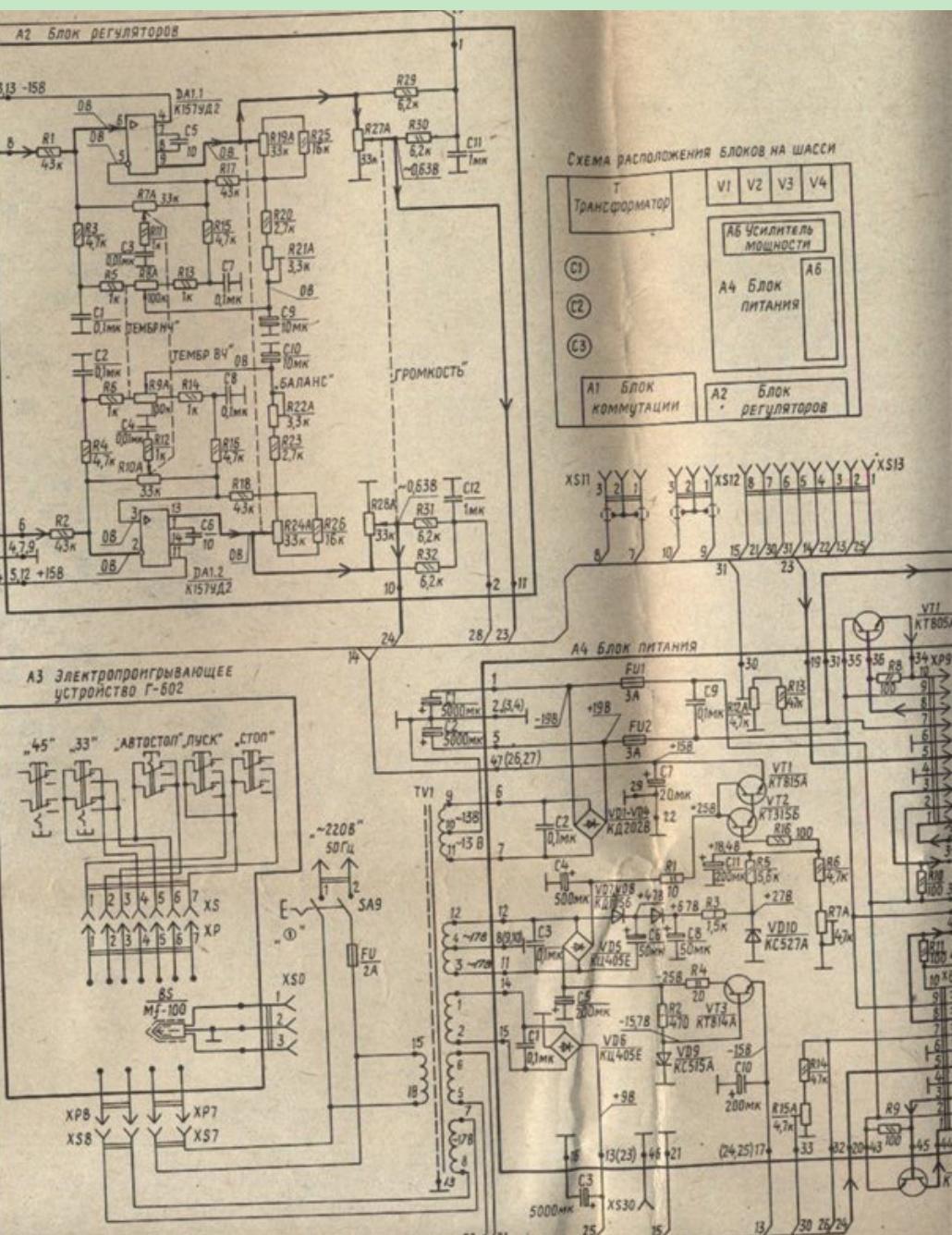
Рабочее напряжение конденсаторов — 500 в.

2.5. Прерывистое движение кинофильма осуществляется грейферным механизмом. Скорость продвижения кинофильма  $24^{+1}_{-0,5}$  кадра в секунду.

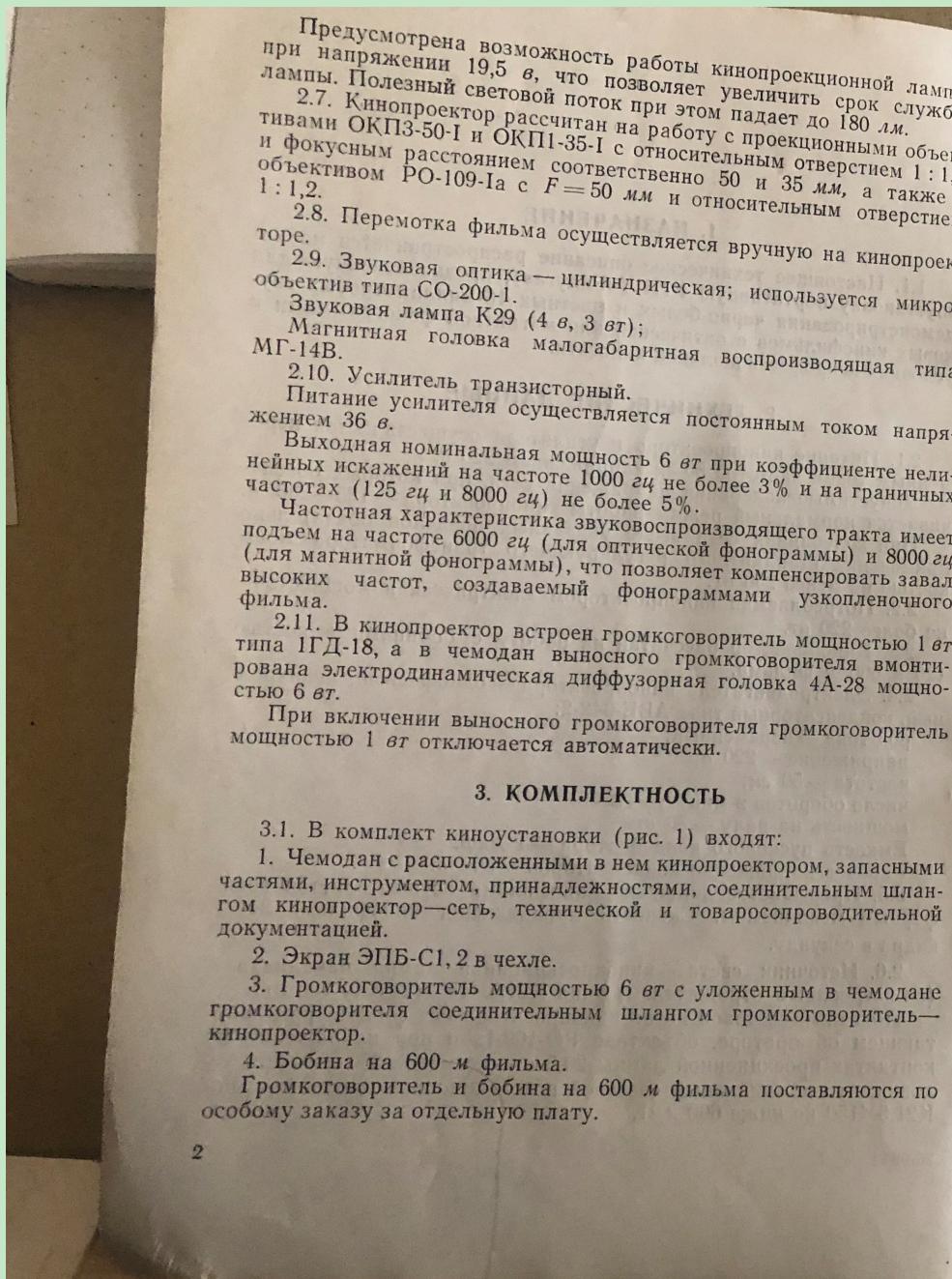
2.6. Источник света — кинопроекционная лампа накаливания (со встроенным отражателем) типа К21,5×150 (21,5 в, 150 вт).

Полезный световой поток кинопроектора без фильма при работающем обтюораторе, объективе РО-109-Іа и при напряжении на контактах проекционной лампы 20,5 в — не менее 250 лм (при условии, что номинальный световой поток кинопроекционной лампы К21,5×150 не ниже 600 лм).





## **scheme of Raduga**



Предусмотрена возможность работы кинопроекционной лампы при напряжении 19,5 в, что позволяет увеличить срок службы лампы. Полезный световой поток при этом падает до 180 лм.

2.7. Кинопроектор рассчитан на работу с проекционными объективами ОКП3-50-1 и ОКП1-35-1 с относительным отверстием 1 : 1,5 и фокусным расстоянием соответственно 50 и 35 мм, а также объективом РО-109-1а с  $F = 50$  мм и относительным отверстие 1 : 1,2.

2.8. Перемотка фильма осуществляется вручную на кинопроеекторе.

2.9. Звуковая оптика — цилиндрическая; используется микроядерный объектив типа СО-200-1.

Звуковая лампа К29 (4 вт, 3 вт);  
Магнитная головка малогабаритная воспроизводящая типа МГ-14В.

2.10. Усилитель транзисторный.  
Питание усилителя осуществляется постоянным током напряжением 36 в.

Выходная номинальная мощность 6 вт при коэффициенте нелинейных искажений на частоте 1000 Гц не более 3% и на граничных частотах (125 Гц и 8000 Гц) не более 5%.

Частотная характеристика звуковоспроизводящего тракта имеет подъем на частоте 6000 Гц (для оптической фонограммы) и 8000 Гц (для магнитной фонограммы), что позволяет компенсировать завал высоких частот, создаваемый фонограммами узкопленочного фильма.

2.11. В кинопроектор встроен громкоговоритель мощностью 1 вт типа ГД-18, а в чемодан выносного громкоговорителя вмонтирована электродинамическая диффузорная головка 4А-28 мощностью 6 вт.

При включении выносного громкоговорителя громкоговоритель мощностью 1 вт отключается автоматически.

### 3. КОМПЛЕКТНОСТЬ

3.1. В комплект киноустановки (рис. 1) входят:

1. Чемодан с расположенными в нем кинопроектором, запасными частями, инструментом, принадлежностями, соединительным шлангом кинопроектора — сеть, технической и товаровопроводительной документацией.

2. Экран ЭПБ-С1, 2 в чехле.

3. Громкоговоритель мощностью 6 вт с уложенным в чемодане громкоговорителем соединительным шлангом громкоговоритель — кинопроектор.

4. Бобина на 600 м фильма.

Громкоговоритель и бобина на 600 м фильма поставляются по особому заказу за отдельную плату.

## scheme of Raduga



Рис. 1. Комплект киноустановки:  
1 — чемодан с кинопроектором, запасными частями, инструментом и принад-  
лежностями; 2 — громкоговоритель мощностью 6 вт; 3 — экран ЭПБ-С1,2  
в чехле

### 4. КОНСТРУКЦИЯ КИНОУСТАНОВКИ

#### 4.1. КИНОПРОЕКТОР

4.1.1. Кинопроектор (рис. 2) состоит из двух основных частей: механизма с фонарем и электропривода, соединенных между собой механически четырьмя винтами и электрически — разъемом, расположенным внутри проектора.

#### Механизм кинопроектора

4.1.2. Механизм кинопроектора (рис. 3) представляет собой корпус с укрепленными на нем следующими основными узлами и деталями:

элементами передач и фильмопротяжным трактом;  
грейферным механизмом с фильмовым каналом и объективо-  
держателем;  
сматывателем;  
наматывателем;  
узлом гладкого барабана;  
деталями и узлами звукоблока;  
блоком регуляторов;  
деталями подъемного механизма.

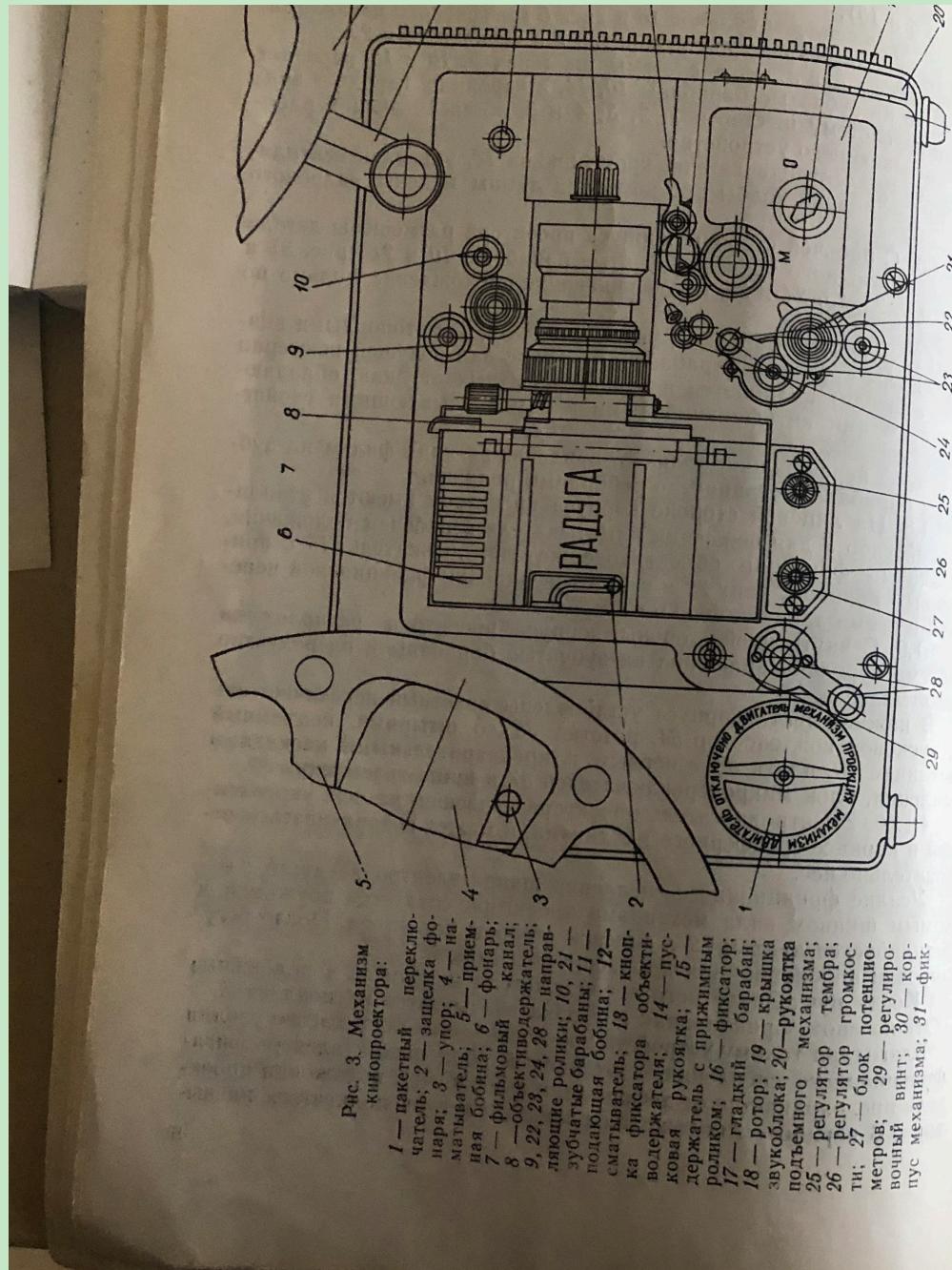
4.1.3. Фильм сматывается с подающей бобины 11 тянувшим зуб-  
чатым барабаном 10, на котором удерживается роликами 9, и, че-  
рез фильмовый канал 7, прерывисто протягивается грейферным  
механизмом.

Из фильмового канала, обогнув успокаивающий ролик 24,  
фильм поступает в звукоблок проектора.

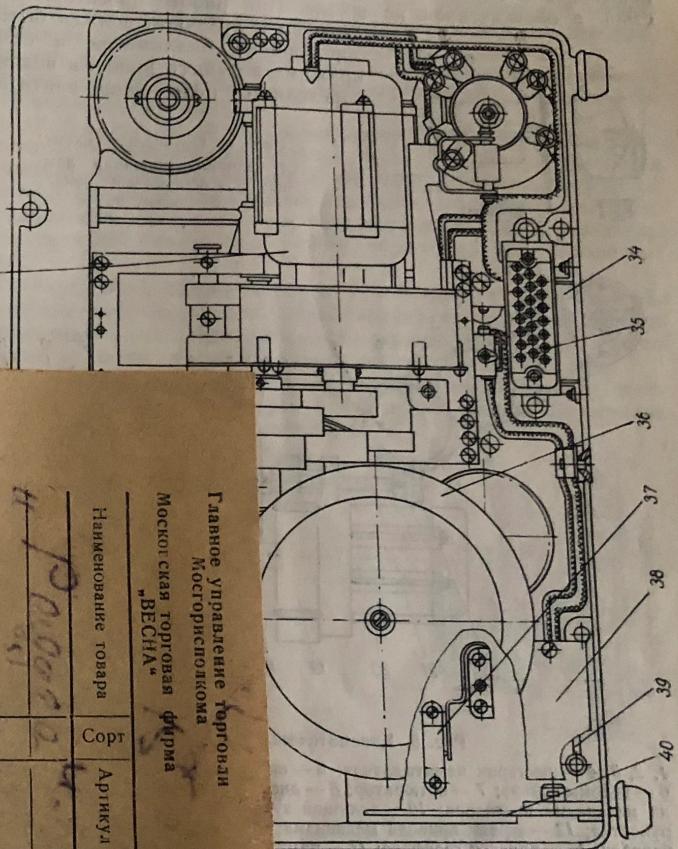
Держатель с прижимным роликом 15 прижимает фильм к глад-  
кому барабану 17. Увлекаемый фильмом гладкий барабан враша-  
ется вместе с укрепленным на его валу маховиком 36.

Рис. 3. Механизм кинопроектора:

1 — пакетный переключатель; 2 — защелка фонарь; 3 — упор; 4 — направляющая ролик; 5 — приемная бобина; 6 — фонарь; 7 — фильковый канал; 8 — объективодержатель; 9, 22, 23, 24, 28 — направляющие ролики; 10, 21 — зуничные барабаны; 11 — подающая бобина; 12 — сматыватель; 13 — кнопка фиксатора объективодержателя; 14 — пусковая рукоятка; 15 — держатель с прижимным роликом; 16 — фиксатор; 17 — гладкий барабан; 18 — ротор; 19 — крышка звукоблока; 20 — рукоятка подъемного механизма; 25 — регулятор тембра; 26 — регулятор громкости; 27 — блок потенциометров; 29 — регулировочный винт; 30 — корпуш механизма; 31 — фиксатор



scheme of Raduga



Главное управление торговли  
Мосгорисполкома  
Московская торговая фирма  
„ВЕСНА“

ЧЕК №

1000

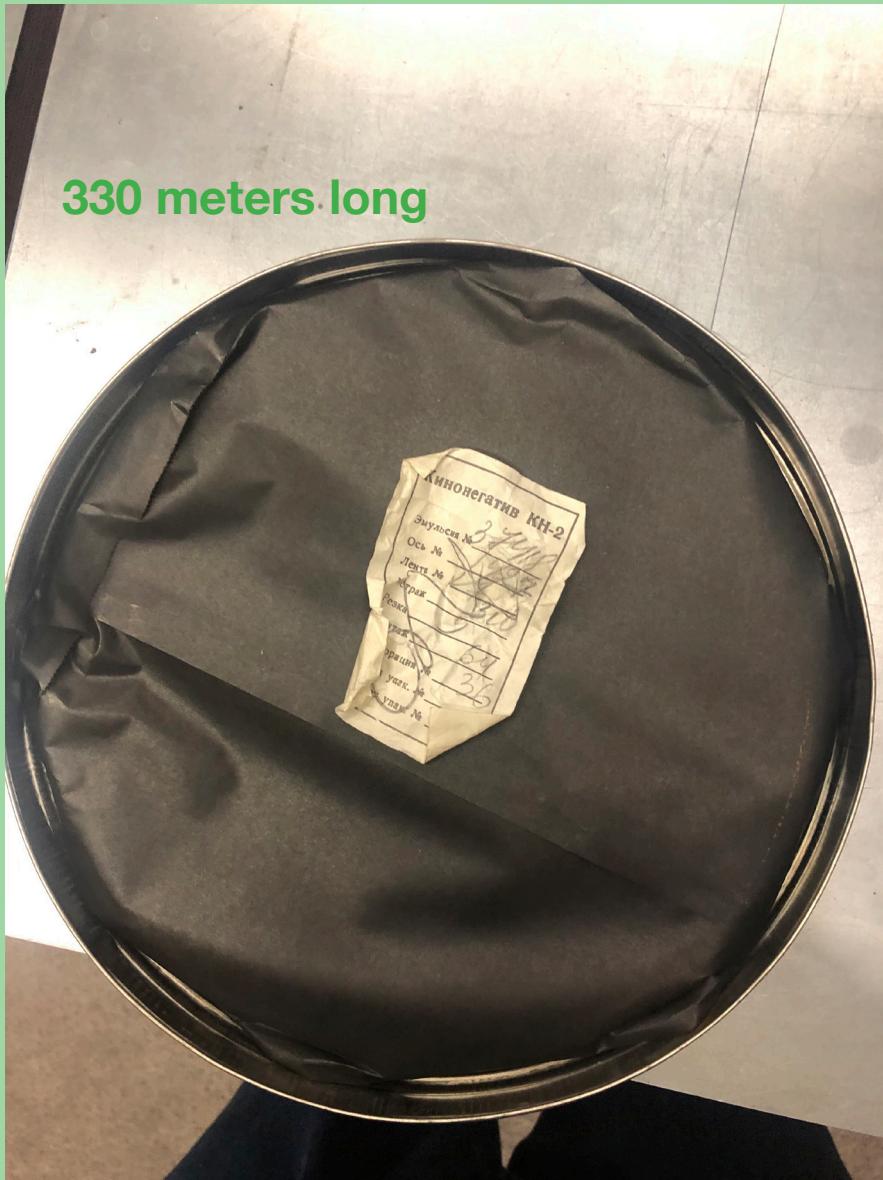
Наименование товара	Сорт	Артикул	Количе- ство	Цена	Сумма
				руб.	к.
				руб.	к.
Raduga				1000	00

Подпись продавца

# 16mm film



196



it turned out to be the most difficult to find a 16 mm sound film for a raduga movie projector, but after a few days searching, I found one on Avito

5

198

# research

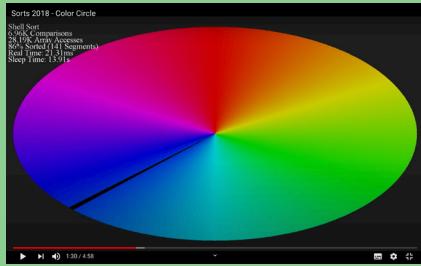
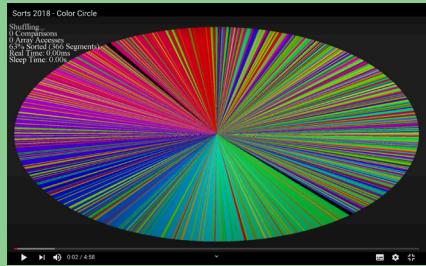
199

200

# techniques and programms

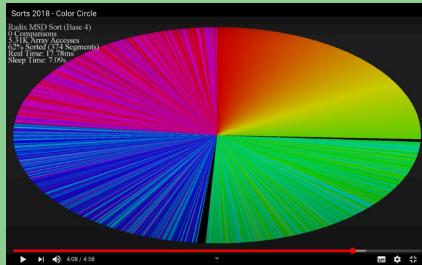
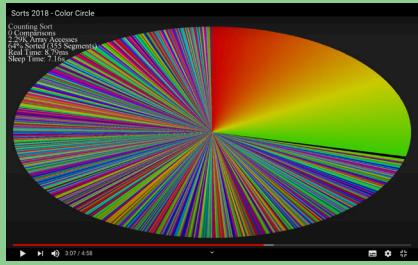
201

# Sorting algorythms



202

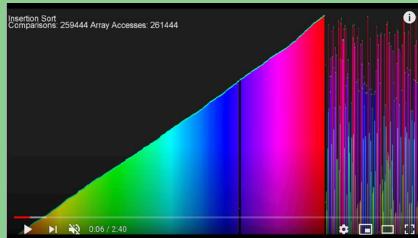
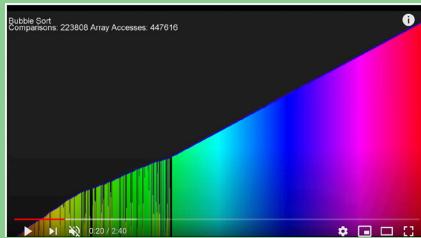
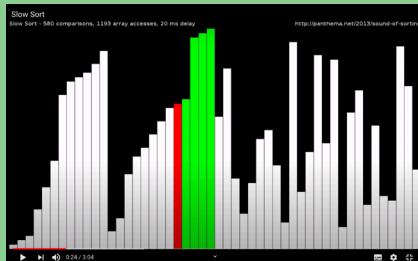
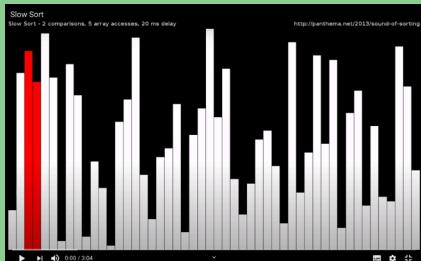
## Color Circle



this is an example of visualizing sounds using code and an algorithm. I found this example randomly when I was looking for information on how to translate a image/graphic into sound

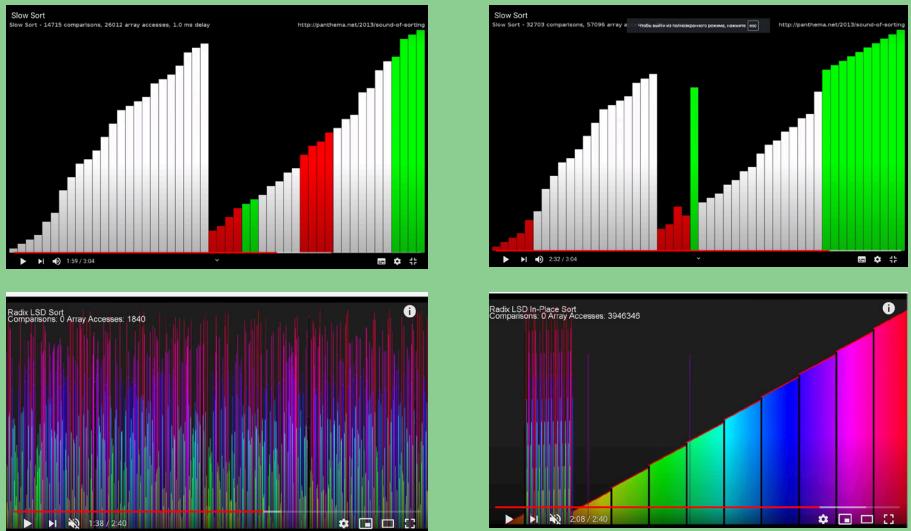
203

# Sorting algorythms



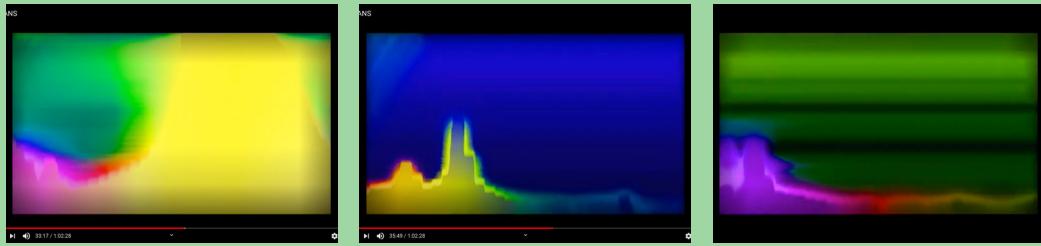
the Sound of Sorting both visualizes the algorithms internals and their operations, and generates sound effects from the values being compared.

# Bogo sorts, 13 sort



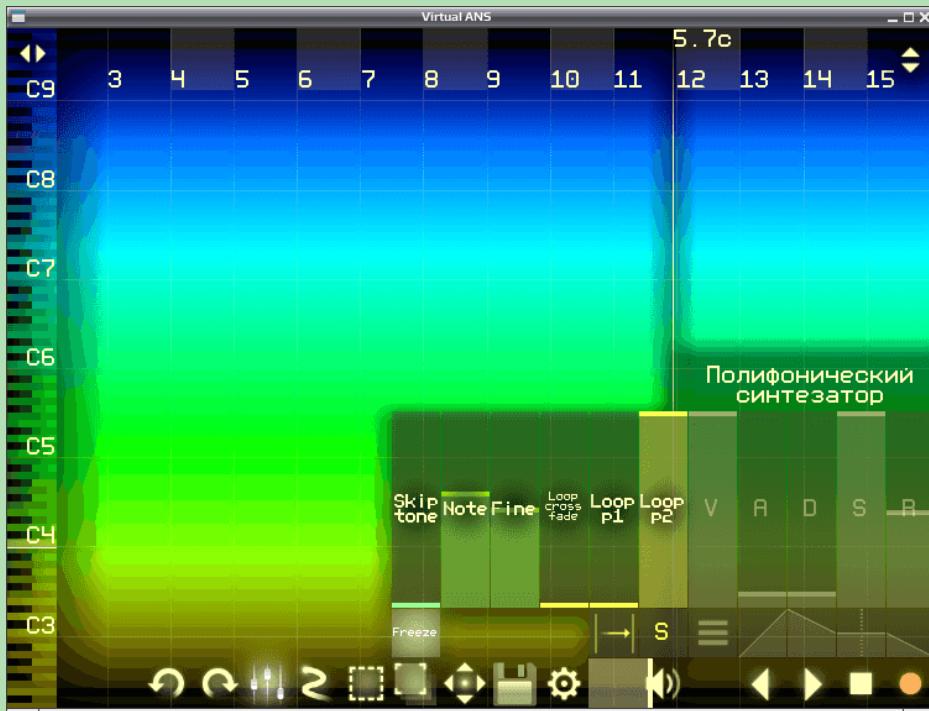


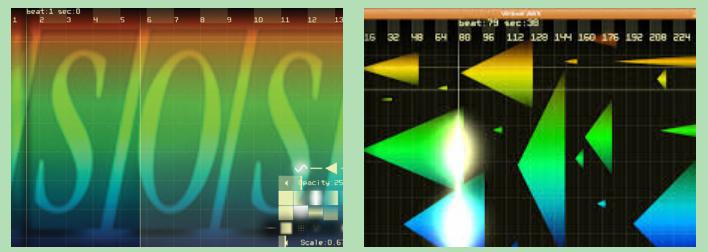
all music composition in this video were created on the ANS photoelectronic optical synthesizer. the recording was made in the fall of 2002 and in addition to John Belans and Peter Christofferson, Ossian Brown, Thighpaulsandra and Ivan Pavlov aka CoH took part in it.



In addition to the Norman Maclaran technique, I also wanted to make a collection of ans sounds and visualize them

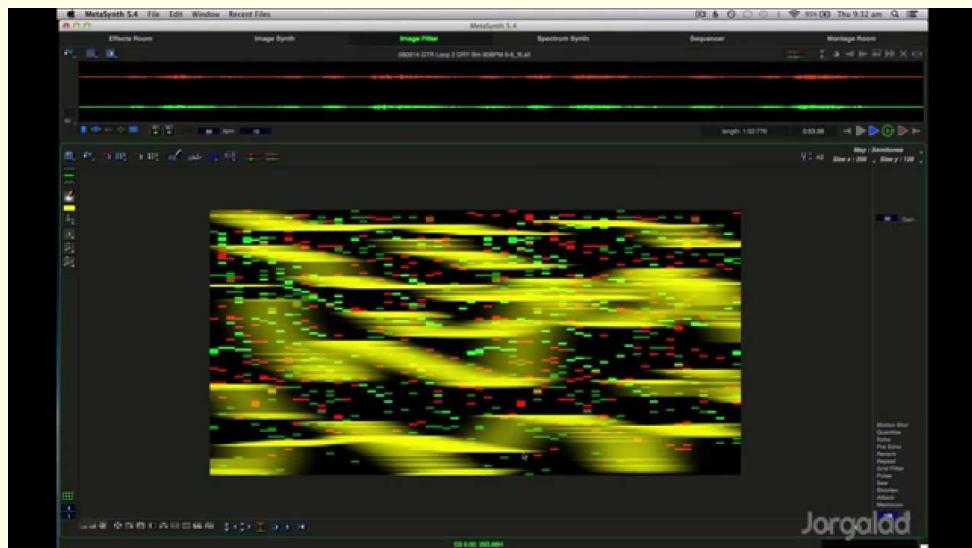
# Virtual ans



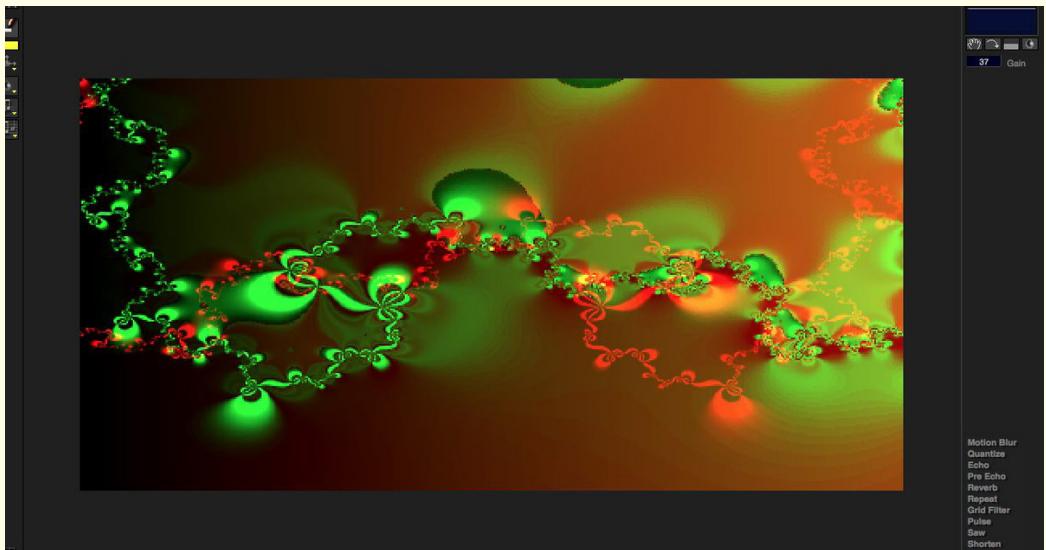


synthesizer software simulator ANS, which allows to draw music in the form of a spectrogram, without the participation of live instruments and artists. The principle of operation is identical to the original ANS

# Metasynth



210



This is an application for the Macintosh operating system, which allows you to create sound from images.

# Barcoders jamming



they connected barcode scanners to speakers instead of cash registers.  
And played a whole concert.

212



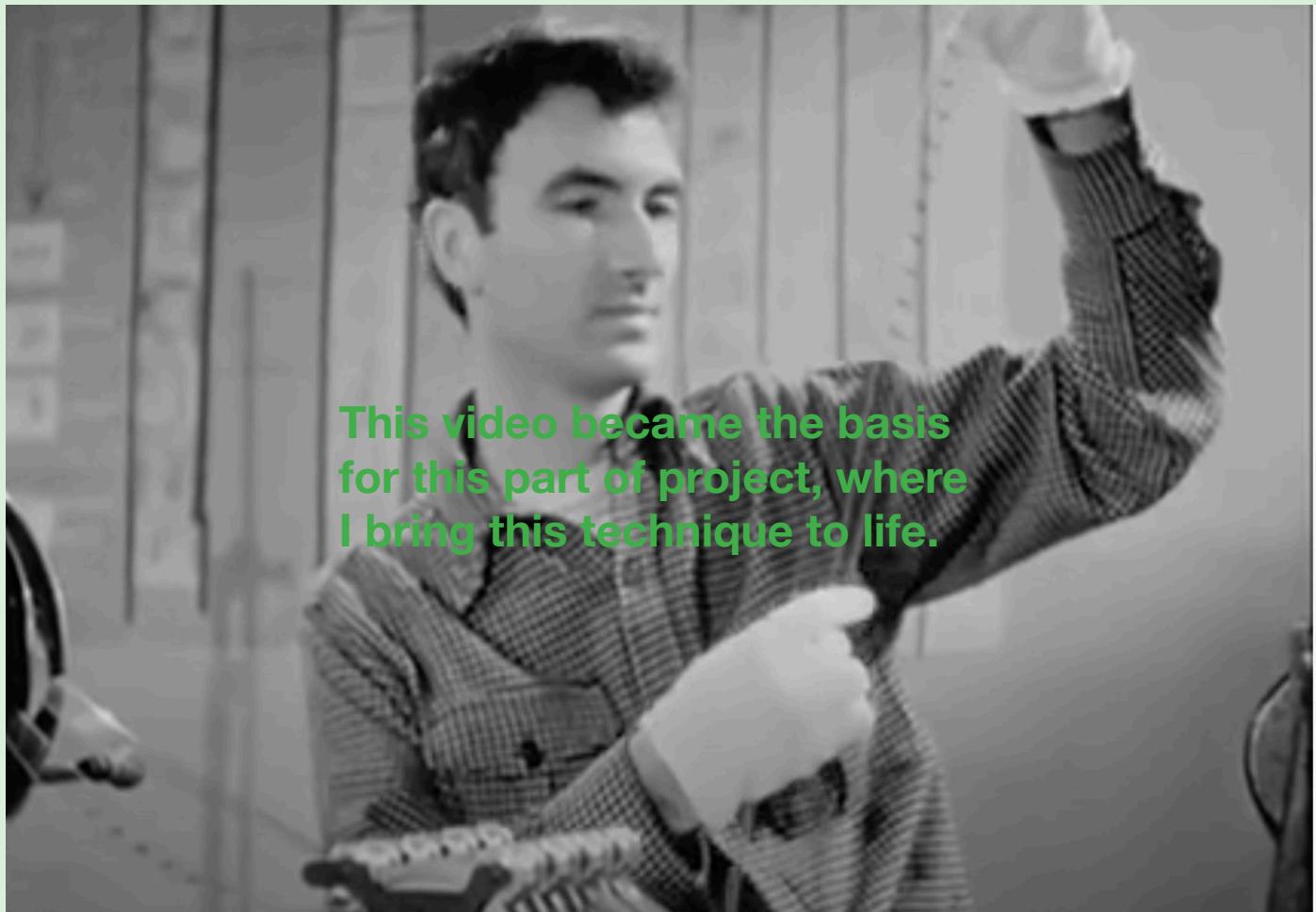
Barcoder: generates sounds by connecting scan-signals of a barcode scanner directly to a powered speaker, not a cash register. Created by Hideki Tanaka + Ei Wada + Nicos Orchest-Lab Played by Ei Wada

# Pen Point Percussion



An introduction to the drawn sounds of Norman McLaren.

Norman Maclaren was inspired by the Soviet sounding technique of the drawn sound. And repeated it only in a simpler way.



This video became the basis  
for this part of project, where  
I bring this technique to life.

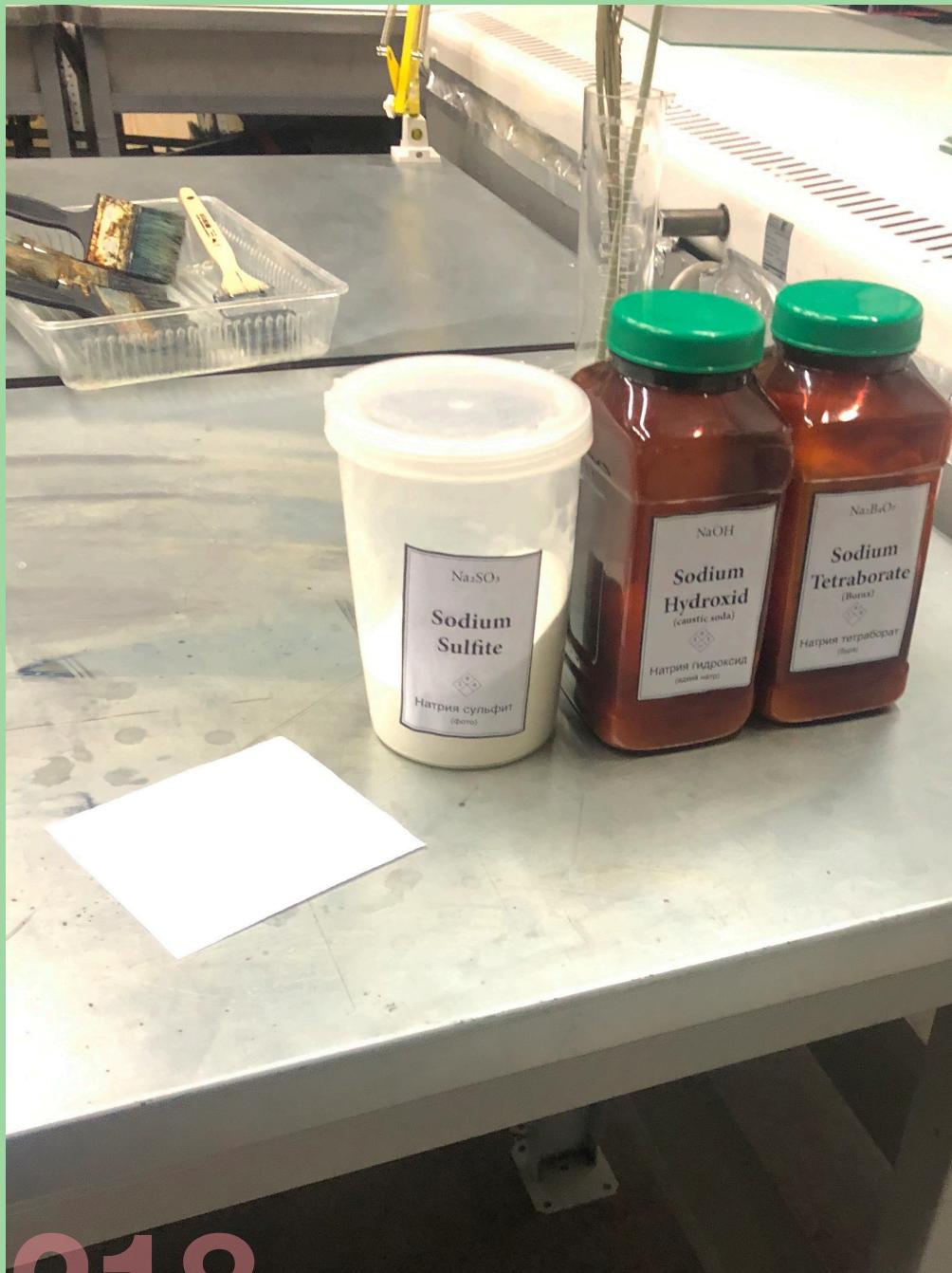
He was a pioneer in a number of areas of animation and filmmaking, including drawn on film animation, visual music, abstract film, pixilation and graphical sound.

# 6

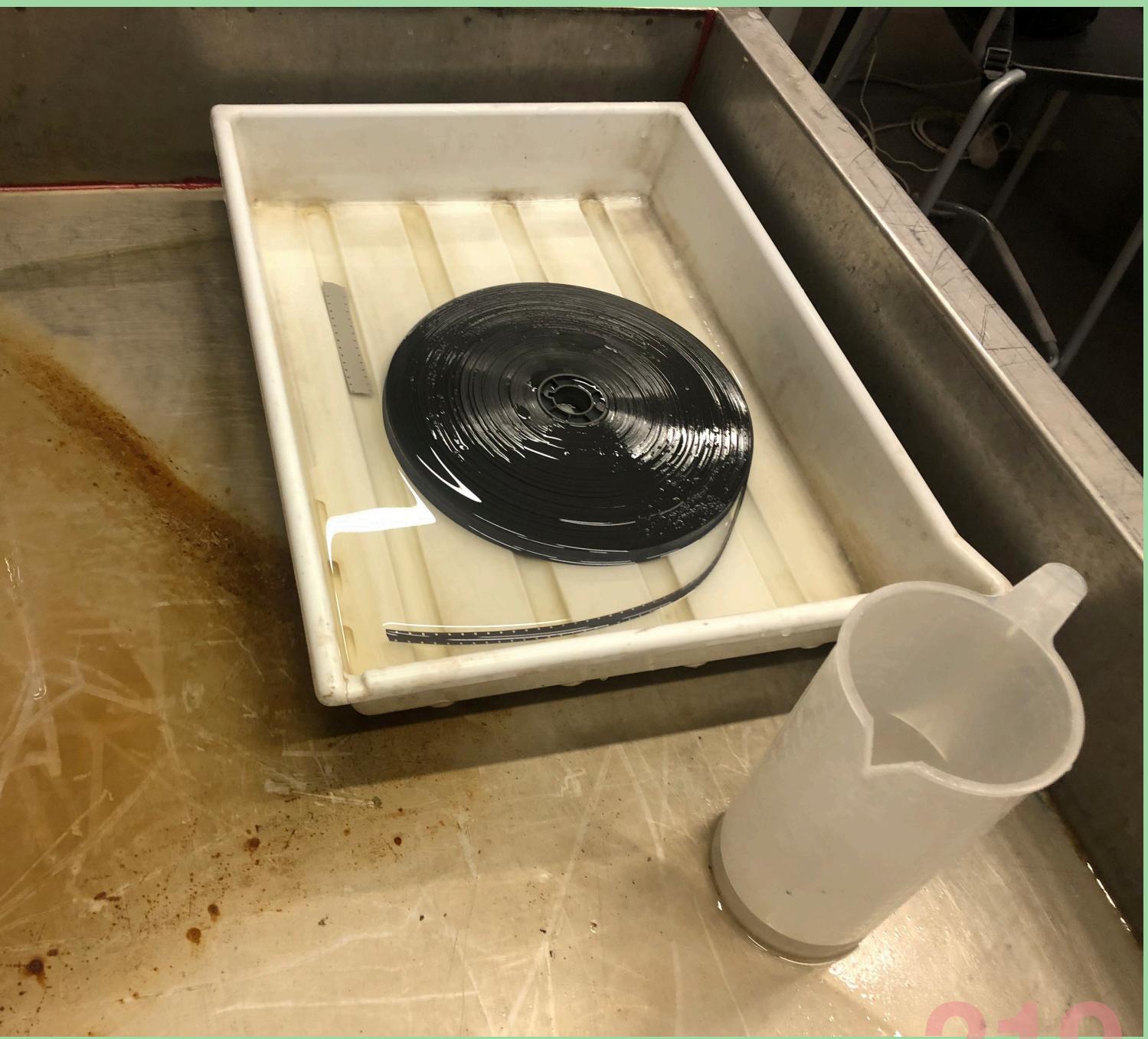
216

# prototyping

# darkroom



218



the first step was to wash the emulsion from the film with chemicals :  
sodium sulfite, sodium hydroxid and sodium tetraborate

219

# darkroom



the second step was to wash off the chemicals by soaking the film in a special liquid, and then immediately put it into cold running water, the problem was that it was 330 meters long, it took me 5 hours to complete this step.

220

step 2



# darkroom

step 3 was to dry the entire film through a film dryer and roll it back, it turned out even longer than the second stage...



step 3



223





at 7:30, the darkroom was closed and I had to put the film in a huge dust bag to bring it home and continue to dry with paper towels and a hairdryer.

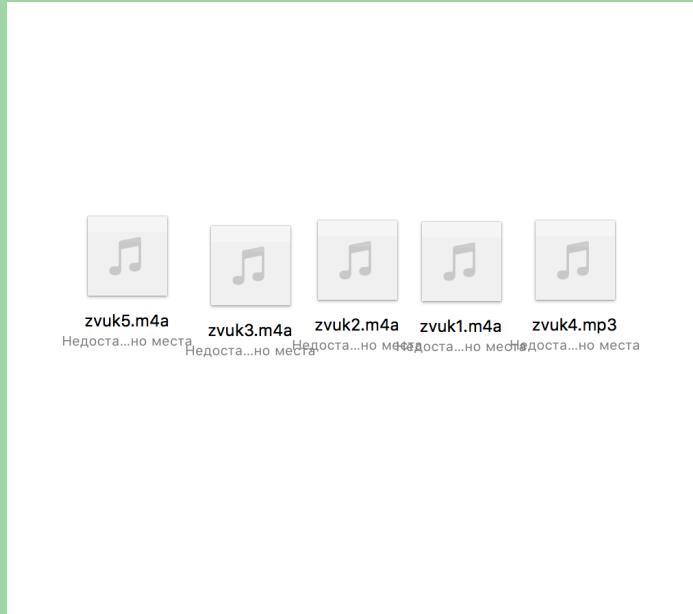
226

# experiments

227

# film experiments

here should be a photo  
of the process



I managed to repeat of drawn sound technique before my film coil broke and quarantine started, but unfortunately at the time of the first and last experiments my phone broke down and was in service for several days, I was not able to document this process, but I managed to record these sound experiments on a computer through a microphone, at that moment I thought there would be another possibility to do more experiments and buy a new coil, but quarantine started and this became impossible.

# fl experiments



In addition to experiments with the movie projector, I made experiments in the fl studio program, I redrawn the Avraamov's ornaments and play them through the programm synthesizer.

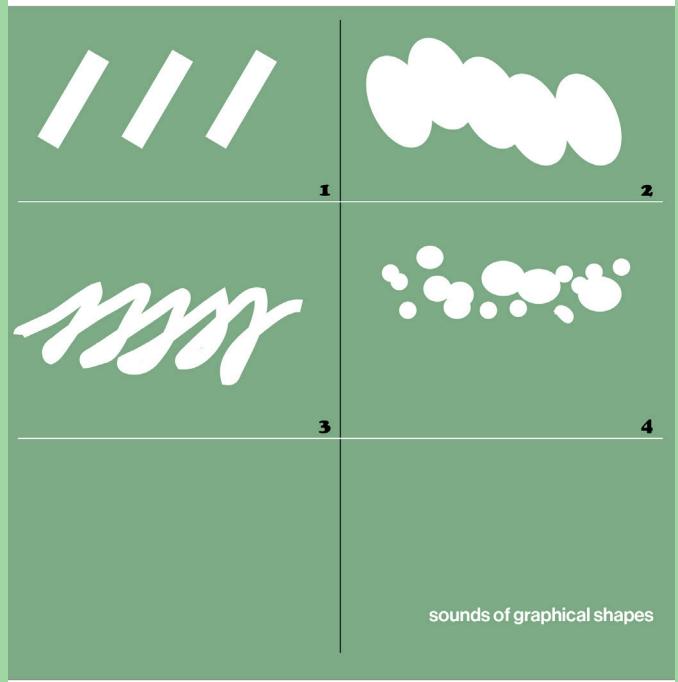
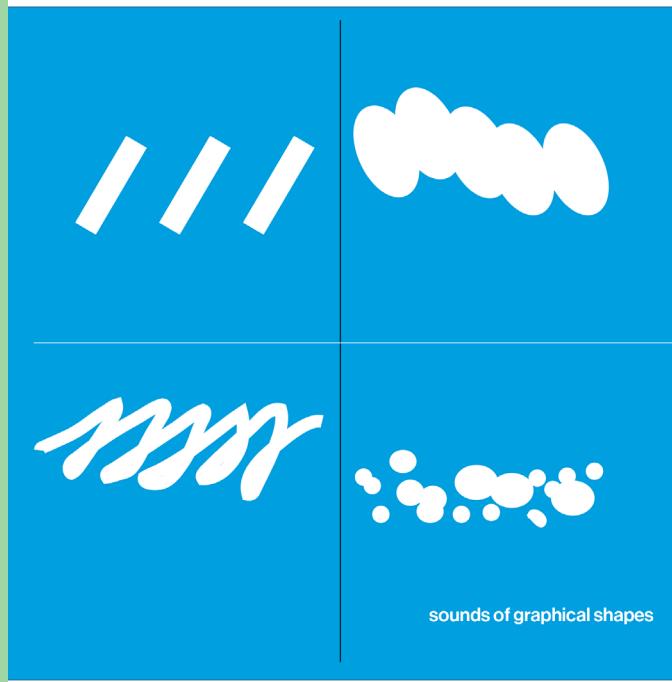


232

**covers**

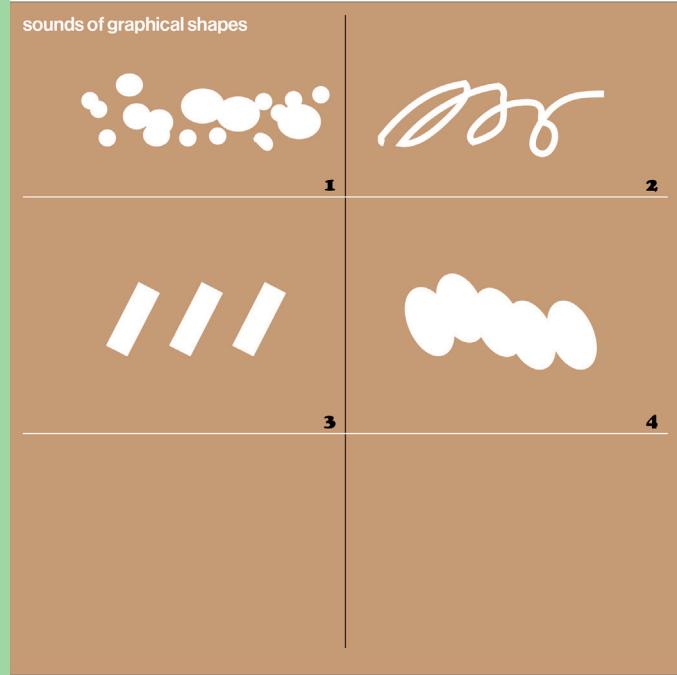
**233**

# covers



234

even before quarantine, I thought that for my sound collection I'll make covers, these are prototypes.



# covers

sounds



of



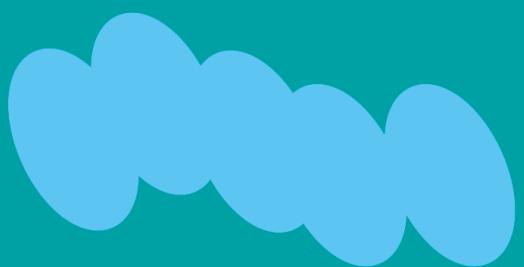
graphical

shapes

sounds



of



graphical

shapes

7

238

# website

239

240

**drafts**

**241**

# draft 1

Graphical sound is a sound recording created from images drawn directly onto film or paper that were then played back using a sound system. There are several different techniques depending on the technology employed, but all are a consequence of the sound-on-film technology and based on the creation of artificial optical polyphonic sound tracks on transparent film.

By 1936 there were several main, relatively comparable trends of Graphical Sound in Russia: - Hand-drawn Ornamental Sound, achieved by means of shooting still images of drawn sound waves on an animation stand, with final soundtracks produced in a transversal form (Arseny Avraamov, early Boris Yankovsky); - Hand-made Paper Sound with final transversal soundtracks (Nikolai Voinov) - The Variophone or Automated Paper Sound with soundtracks in both transversal and intensive form (Evgeny Sholpo, Georgy Rimsky-Korsakov); - The Syntones method, based on the idea of spectral analysis, decomposition and resynthesis, developed in 1932-1935 by a pupil of Arseny Avraamov, the young painter and acoustician Boris Yankovsky.

This website is part of project about Graphical sound. Studying this theme, I repeated the technique of graphic sound, using the old Soviet projector and film strip. This part is a tribute to the Soviet inventors and musicians. Which created a lot of inventions that influenced the development of electronic music.

Yankovsky

Voinov

Sholpo

the key element on this page was a spinning circle of names of Soviet inventors; on the name click, you go to my sound experiment

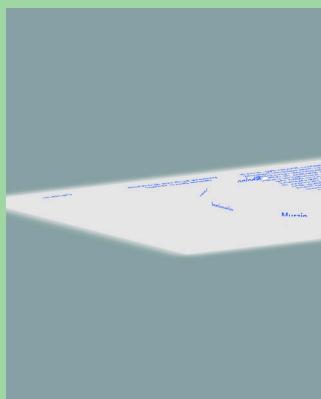
Documentary □

Avraamov

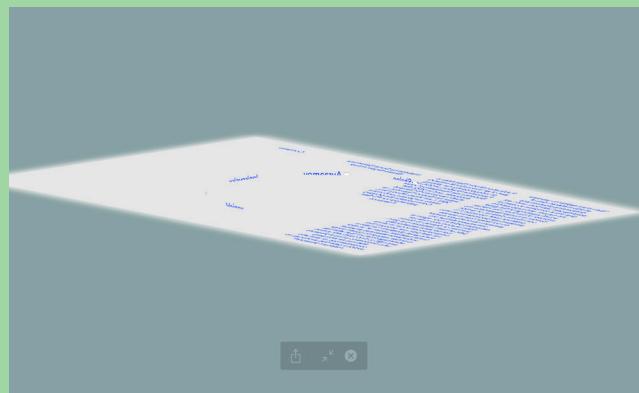
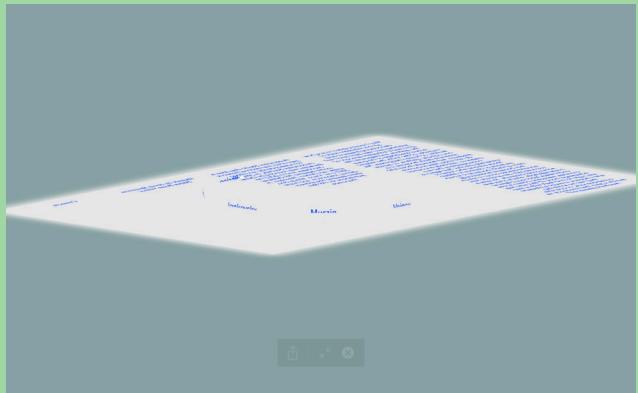
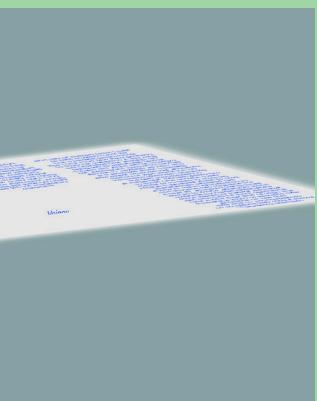
Slobodko

Avraamov





this is a accidental version, the code of the spinning ring with the names from previous example overlapped with the project description page, the rotating page reminded me of a vinyl cover, so I thought to leave this page as it was.



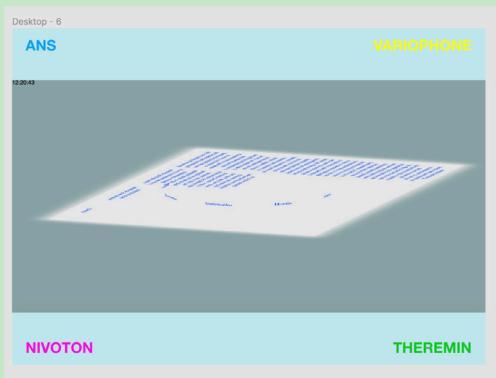
245

# draft 2

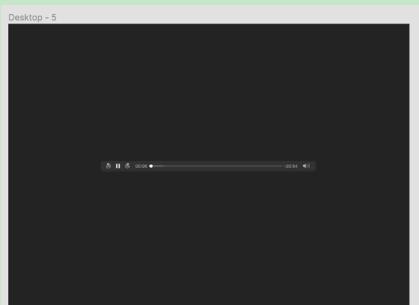


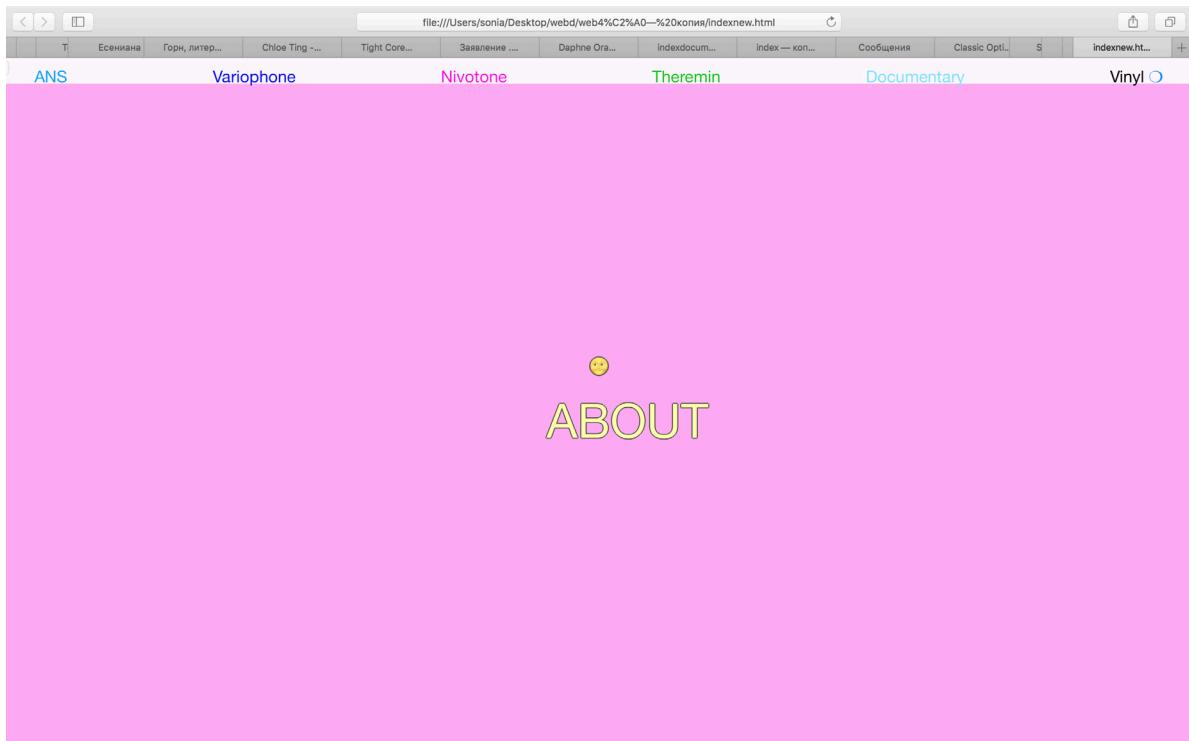
246

I decided that the aesthetics on the site should correspond to the aesthetics of the film. Initially, the site consisted of 4 pages, on the main page there was a button ABOUT and on a click it takes you to a page with a description of the topic and project; on the description page there was a link to a documentary. the idea was that the first thing you pay attention to is a page with the name of the synthesizers (tracks) since the main thing in this part of the project was the musical experiments themselves. on a click goes to a page with sound.

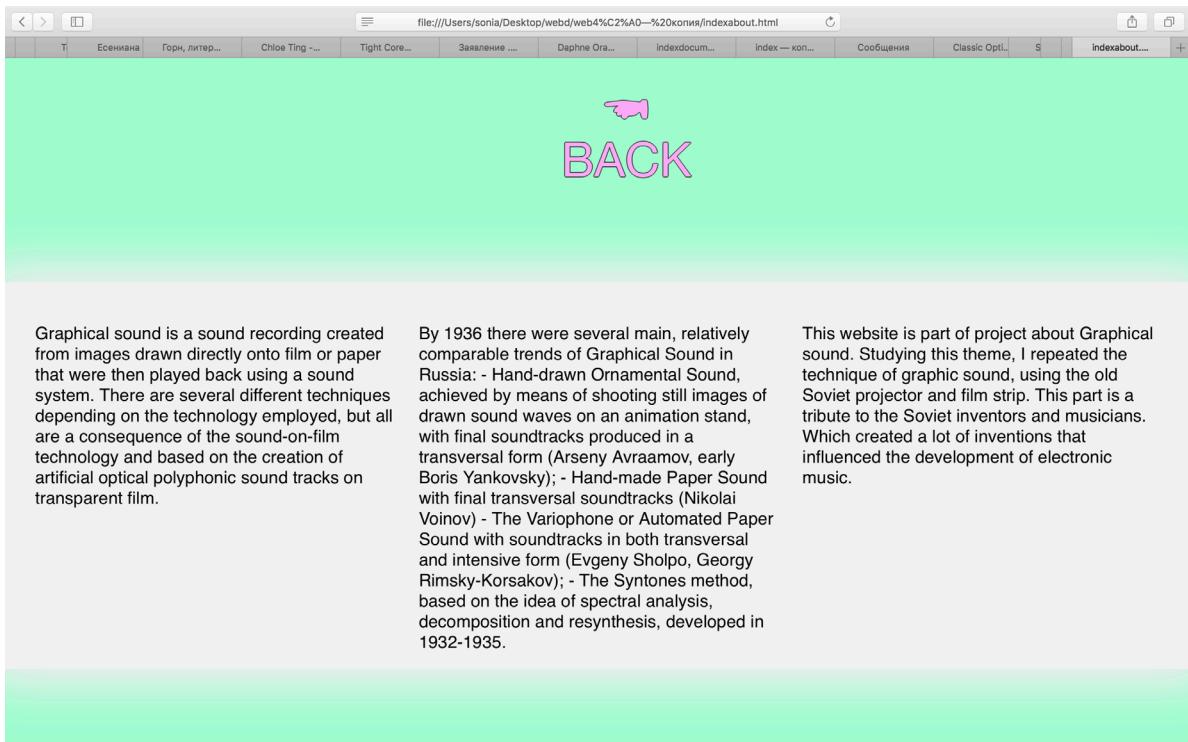


Name	Duration	Listen
Ans	15 sec	mp3
Variophone	27 sec	mp3
Nivotone	10 sec	mp3
Theremin	30 sec	mp3





In this version, I changed the design solutions but I left some elements of the aesthetics of the film, following the same logic as in the previous version, on the main page there are all my musical experiments, and I also added a vinyl link to the top bar, by clicking on the about button takes you to the description page



Graphical sound is a sound recording created from images drawn directly onto film or paper that were then played back using a sound system. There are several different techniques depending on the technology employed, but all are a consequence of the sound-on-film technology and based on the creation of artificial optical polyphonic sound tracks on transparent film.

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ANS      Variophone      Nivotone      Theremin      Documentary      Vinyl

## About



BACK

This is a screenshot of a web page with a light blue background. At the top, there is a horizontal navigation bar with six items: ANS, Variophone, Nivotone, Theremin, Documentary, and Vinyl. Below the navigation bar, the word "About" is displayed in a large, bold, green font. Underneath "About" is a video player showing a person sitting and playing a theremin on stage. The video player includes standard controls like play/pause, volume, and a progress bar indicating the video is at 0:01 and has a duration of 2:46. Below the video player, the word "BACK" is written in a large, yellow, stylized font.

250

this is an example of pages with a documentary and vinyl, the problem was that there was no specific logic, each page had an about or back button, which was a little confusing. the problem of track links was also not resolved, I wanted the link to play either on hover or on click

| ANS

Variophone

Nivotone

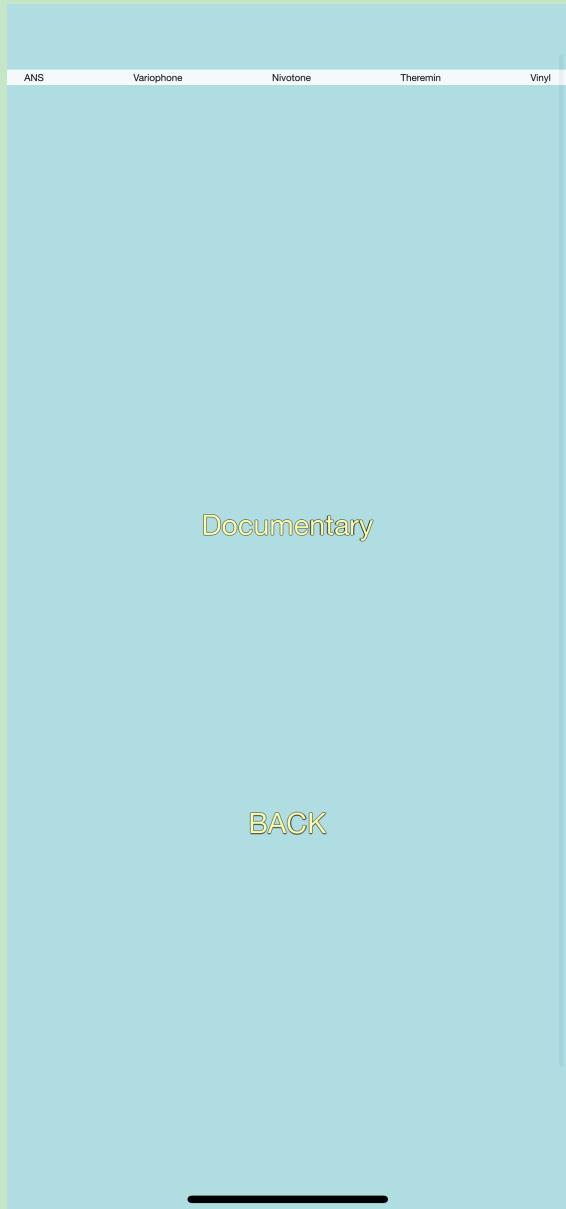
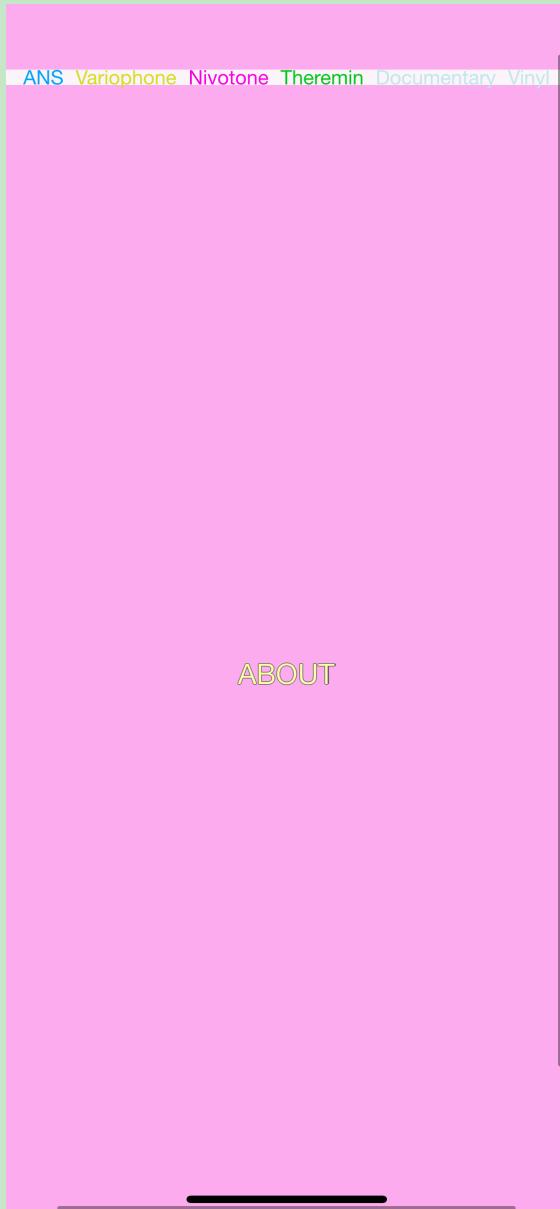
Theremin

Documentary

Vinyl 

## ABOUT

# mobile version



BACK

253

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final

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# main page

ANS \*

Variophone ○

Nivotone



Graphical sour

256

main page with tracks and a link to the description of the project, themes. I set up links with the names of the tracks, they are played on the click:)





## Tracks

Graphical sound is a sound recording created from images drawn directly onto film or paper that were then played back using a sound system. There are several different techniques depending on the technology employed, but all are a consequence of the sound-on-film technology and based on the creation of artificial optical polyphonic sound tracks on transparent film.

By 1936 there were several main, relatively comparable trends of Graphical Sound in Russia:

- Hand-drawn Ornamental Sound, achieved by means of shooting still images of drawn sound waves on an animation stand, with final soundtracks produced in a transversal form (Arseny Avraamov, early Boris Yankovsky);
- Hand-made Paper Sound with final transversal soundtracks (Nikolai Voinov) - The Variophone or Automated Paper Sound with soundtracks in both transversal and intensive form (Evgeny Sholpo, Georgy Rimsky-Korsakov);
- The Syntones method, based on the idea of spectral analysis, decomposition and resynthesis, developed in 1932-1935.

Открыть «file:///Users/sonia/Desktop/webd/webshit/indexnew.html» в новой вкладке

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The project description page which describes two formats of my project, I wanted to make such a transition from tracks to description and further to a documentary film and further in the same cyclical sequence.

## Documentary

This website is part of project about Graphical sound. Studying this theme, I repeated the technique of graphical sound using Soviet movie-projector and film, I drew directly on film and played through the projector. The [tracks](#) on the main page are named after the inventions of Soviet engineers, you can listen them by clicking on them.

# documentary page

The Origins of Electronic Music is devoted to the history of graphic sound.

Among the topics covered in the film are: Forgotten inventions and their sound, Russia in the context of the world history of music.

The film was researcher at Irina Novichkova



Tracks

260

page with a documentary film, on this page instead of links a brief description of the film, the text is divided into 4 columns as on the main page. under the video there is a link to the main page with tracks, it seemed logical to me to switch from a documentary to tracks, and not to a page with a description.

attended by a  
at the Museum of Music  
Kova.

Material collected from  
the Film archive and  
Phono archive





**This is the end of the second part  
of the process of creating sound  
experiments and the site for their  
presentation.**

264



8

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