



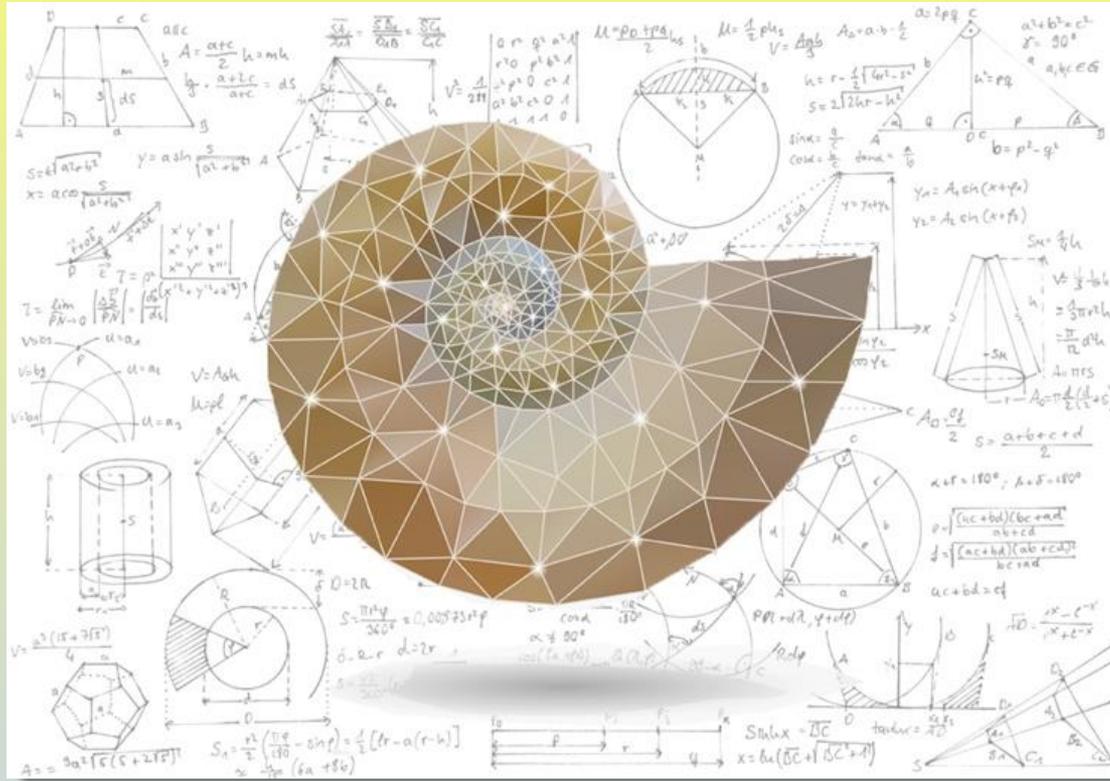
# **Glimpses at Mathematics and Jewish Art**

**Johannes Kepler University – Linz, Austria  
STEM Education Centre**

**STEAM research meeting  
May 4<sup>th</sup>, 2016**

**Noah (Thierry) Dana-Picard**

# Making Art from Equations



<http://discovermagazine.com/galleries/2014/april/math-art>

# **Limitations: Short tidbits on a Jewish attitude to Art**

Whether there exists a form of art that can be described as "Jewish Art" has long been a matter for discussion. What is indisputable is that at every stage of their history the Jews and their ancestors of biblical times expressed themselves in various art forms which inevitably reflect contemporary styles and fashions and the environment in which they lived. For purposes of cult and of religious observance, as well as for household and personal adornment, Jews have constantly produced or made use of objects which appealed in some fashion to their aesthetic sense. In a famous passage (Shab. 133b), the rabbis, commenting on Exodus 15:2, prescribed that God should be "adorned" by the use of beautiful implements for the performance of religious observances. A problem exists, however, regarding the Jewish attitude toward figurative and representational art. The Pentateuchal code in many places (Ex. 20:4; Deut. 5:8 and in great detail 4:16–18) ostensibly prohibits, in the sternest terms, the making of any image or likeness of man or beast.

## **Exodus 20,3 – Ten commandments**

“Thou shalt not make unto thee a graven image, nor any manner of likeness, of any thing that is in heaven above, or that is in the earth beneath, or that is in the water under the earth”

# Pros and Cons until 19th century

## May exist

- Torah scrolls ornaments
- Enluminated books
- Music
- Etc...

## May not exist

- Monuments
- Sculptures
- Figurative pictures of animals and human beings
- Etc...

# Jewish Art: Ancient items

Panel from a Torah Shrine from the Ben Ezra Synagogue in Cairo, 11th century, wood (walnut) with traces of paint and gilt, 87.3 x 36.7 cm (The Walters Art Museum). The patterns of vine scrolls and lozenges shows the influence of Islamic art.

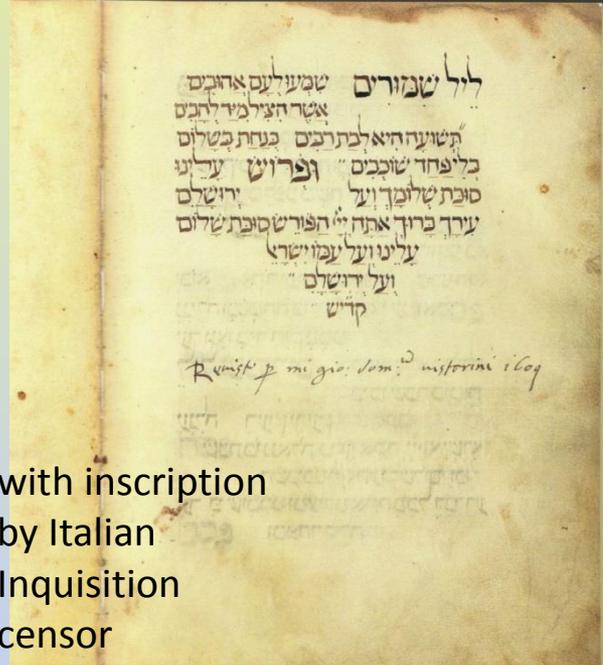


Santa Maria la Blanca, former synagogue in Toledo, Spain. Erected in 1180, it may be the oldest synagogue in Europe still standing. It is now owned and preserved by the Catholic Church as a museum  
photo: Nik McPhee (CC BY-SA 2.0)

# Books



Left: Taking his family back to Egypt, Moses meets Aaron on the way and Zipporah, holding two babies in her arms, rides a mule; right: an angel appears above the bush that burns but is not consumed and on divine instructions, Moses takes off his shoes and hides his face when he hears the voice of God. Upper part of a page from the **Golden Haggadah, c. 1320, Northern Spain, probably Barcelona** (British Library, MS. 27210, fol. 1o verso)



with inscription  
by Italian  
Inquisition  
censor



The Sarajevo Haggadah - One of the most magnificent Jewish manuscripts, a book that survived two inquisitions and a Holocaust, is sitting trapped behind closed doors in Bosnia's slowly crumbling National Museum, held captive by the dizzyingly convoluted politics of the Balkan nation.

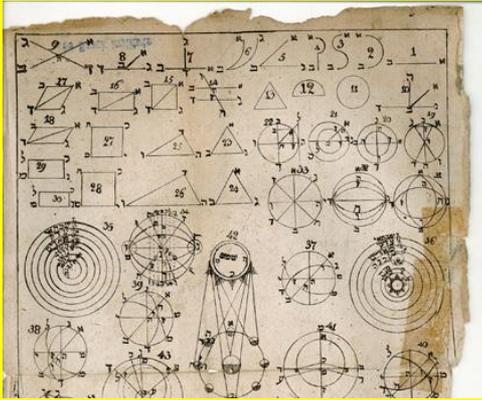
# Religious items

**Torah Crown**, 1698-99, Bolzano, Italy (The Jewish Museum, New York) “Originally dedicated to an Italian synagogue in 1698/99, this crown was later plundered during a Russian pogrom and then recovered. It became part of the collection of the Great Synagogue of Danzig in the early 20th century. In 1939, it was sent to the Jewish Theological seminary in New York for safekeeping when the Nazis' rise to power forced the Danzig Jewish community to disband.”



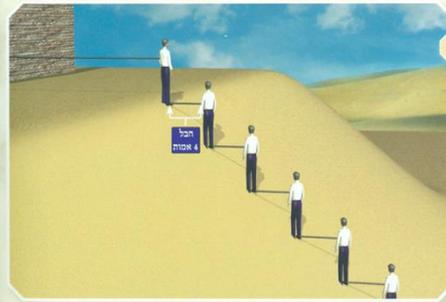
**Torah Case**, Iraq, 19th-early 20th century, silver overlaid on wood, with coral set cresting (The Jewish Museum, London)

# Jewish Maths (Talmud)

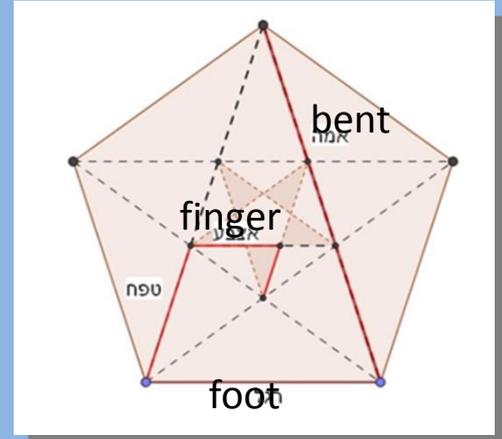


Computing the Jewish Calendar (lunar and solar)

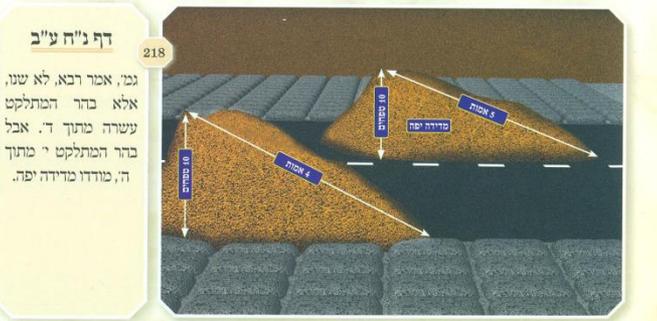
An approach looking as integral calculus



דף נ"ח ע"א  
 215  
 מותני, אם אתו יכול להבליעו. א"ר דוכתא, שמועתי שמוקדוין בדריים. ומס"י, שגדקין לוחו סתכל על ד' לוחות, וסתתרו מנח סתכל כנגד לבו, וסתלקו כנגד מנתלוחיו.



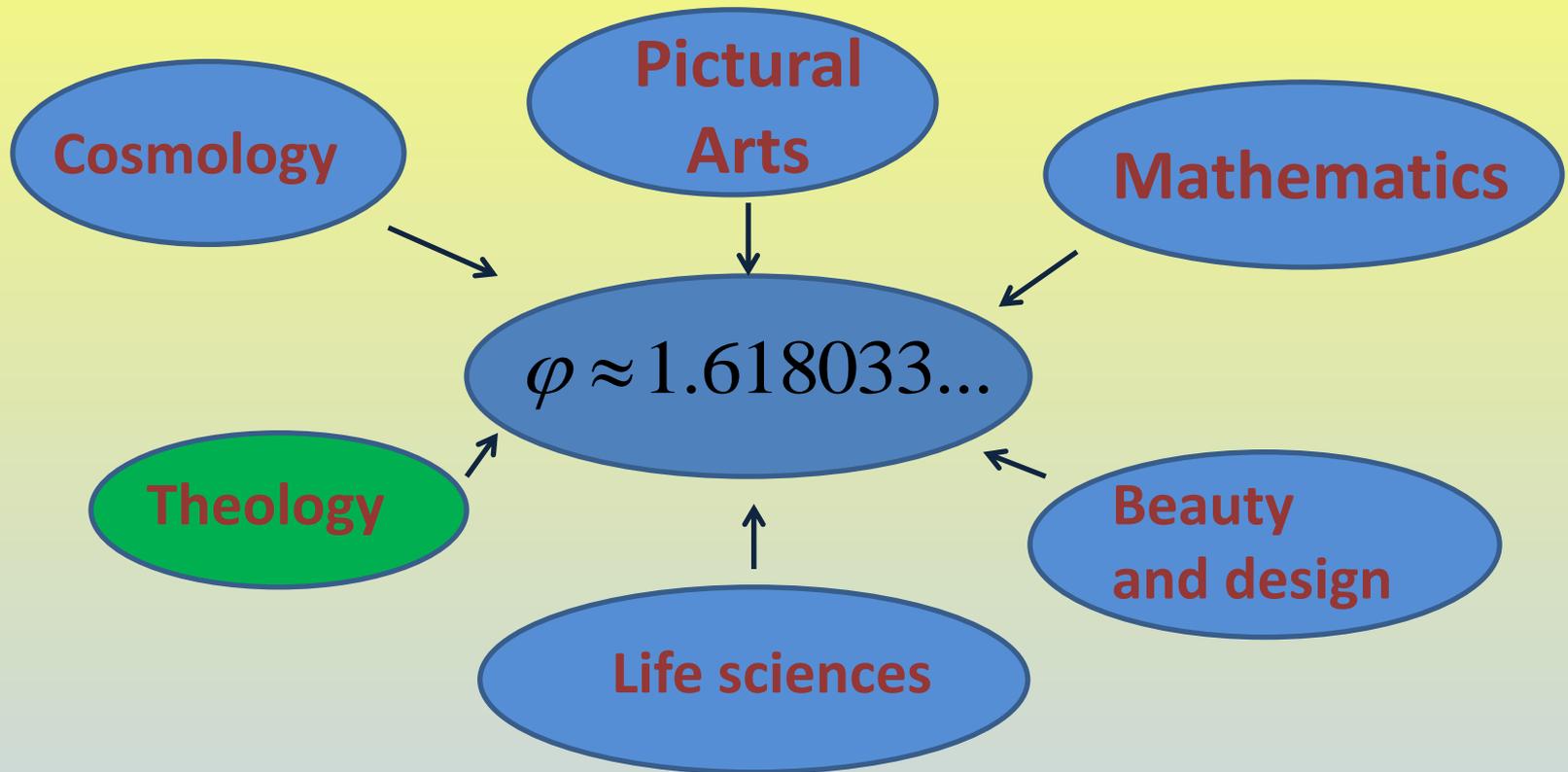
Biblical length units:  
 Fibonacci numbers



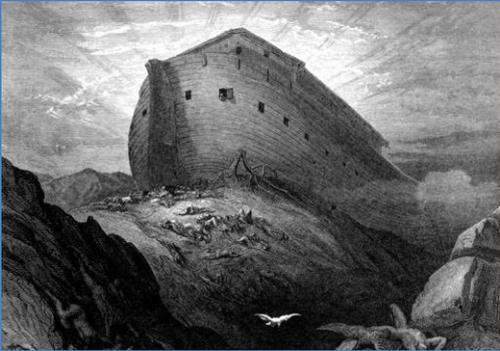
Trigonometry



# Golden section



# Fibonacci numbers and Golden section



Noah's Arch: 50x30



The Holy Arch: 2.5x1.5



Garment fringes



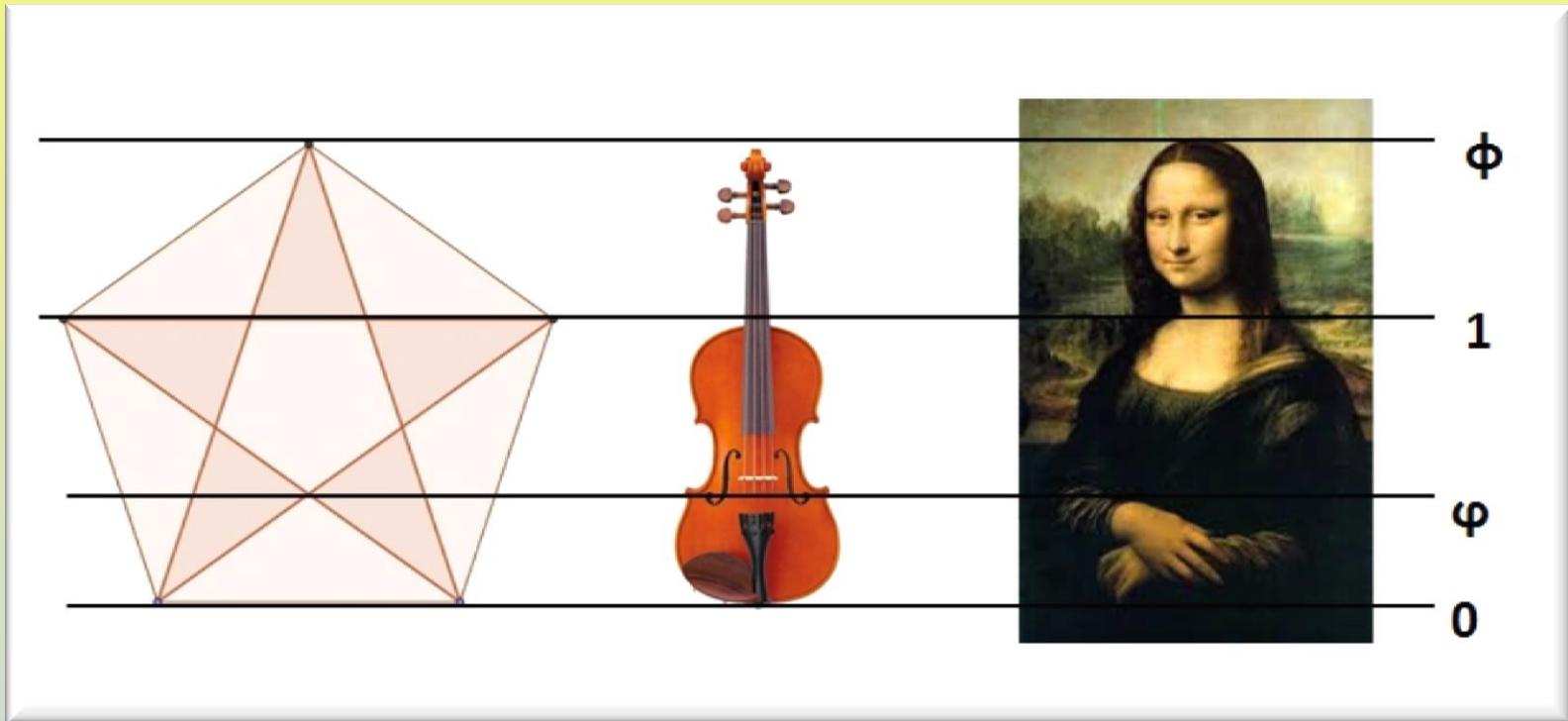
The copper altar: 5x3

$$\frac{50}{30} = \frac{5}{3} = \frac{2.5}{1.5} = 1.6 \approx \varphi$$

$$\varphi = \frac{1 + \sqrt{5}}{2} \approx 1.618033\dots$$

Ref: DP and G. Morali, book to appear, 2016.

# A non official reason why Jews play so often the violin



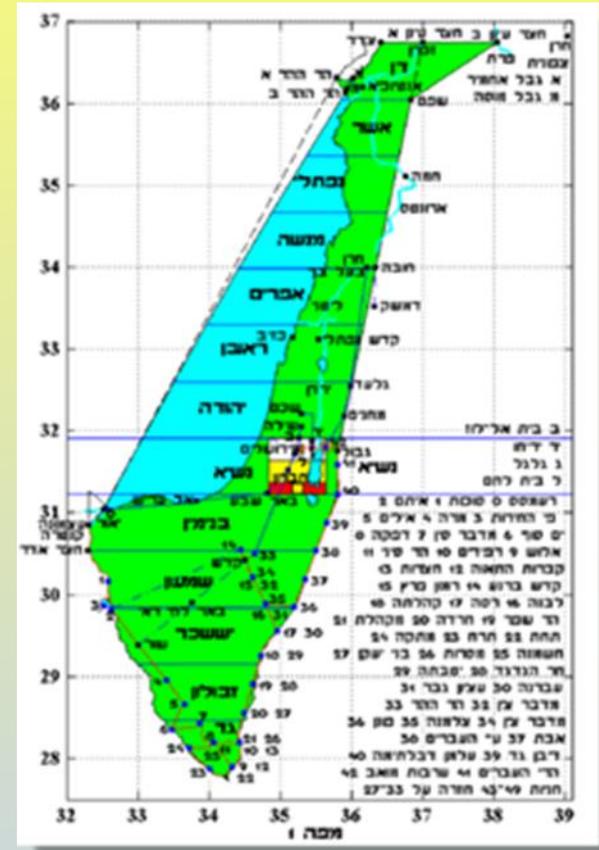
# Architecture

## The Holy Temple of Jerusalem



**Model of the Temple (Herod's period)**  
**Jerusalem Museum**

The Temple dimensions and its compound's dimensions are related to Fibonacci numbers



The ratio of the distances to the northern and the southern biblical border lines of the Land of Israel is an approximation of the Golden Ratio



# Dohány Street Synagogue in Budapest

Symmetry and transformation groups



# fractals

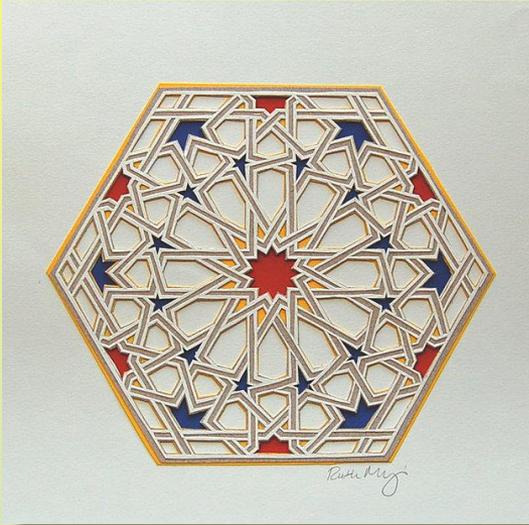
## Traditional pastry

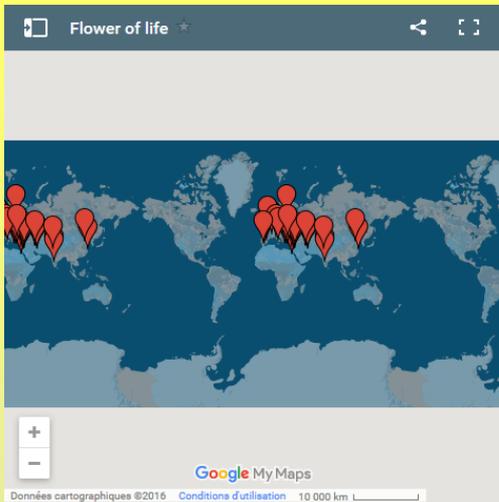


## 3D printing

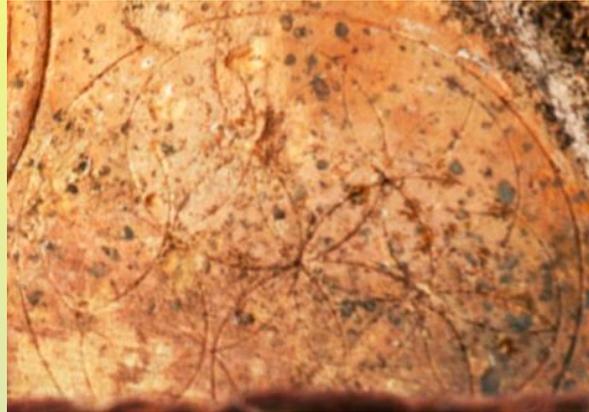


# Jewish Art – Tessellations and mosaics





# « flower of life » non typically Jewish



Presumably [Assyrian wall decoration](#) in the Pergamon Museum in Berlin. Undated. (Photo credit: Sanjin Đumišić)



A Jewish painting that has a Hebrew inscription around the circle of the Flower of Life. Undated.

A six-petal flower lunette above the door of the Orthodox chapel (upper picture). More complex pattern of the intersecting circles can be seen on both sides of the center circle when picture is zoomed in (lower picture). Patmos, Chora, Greece. Undated. (Photo credit: Marko Manninen)



# Traditional cantillation biblical texts

הַמְעִיל סָבִיב: **לה** וְהָיָה עַל־אֶהְרֹן לְשָׂרְתָּ וְנִשְׁמָע קוֹלוֹ בְּבֵאוֹ אֶל־הַקֹּדֶשׁ לְפָנָי יִהְיֶה וּבְצֵאתוֹ  
וְלֹא יָמוּת: **{ס}** **לו** וְעָשִׂיתָ צִיץ וְזָהָב טָהוֹר וּפְתִיחַתָּ עָלָיו פְּתוּחֵי חֹתֶם קֹדֶשׁ לַיהוָה: **לז**  
וְשִׂמְתָּ אֹתוֹ עַל־פְּתִיל תְּכֵלֶת וְהָיָה עַל־הַמְצַנֶּפֶת אֶל־מֹול פְּנֵי־הַמְצַנֶּפֶת יִהְיֶה: **לח** וְהָיָה  
עַל־מִצַּח אֶהְרֹן וְנִשָּׂא אֹהֶן אֶת־עֵינָיו הַקְּדוּשִׁים אֲשֶׁר יִקְדִישׁוּ בְנֵי יִשְׂרָאֵל לְכָל־מִתְנַת  
קֹדְשֵׁיהֶם וְהָיָה עַל־מִצְחוֹ תָמִיד לְרָצוֹן לָהֶם לְפָנָי יִהְיֶה: **לט** וְשִׁבְצָתָּ הַכֹּתֹנֶת שֵׁשׁ וְעָשִׂיתָ  
מְצַנֶּפֶת שֵׁשׁ וְאַבְנֵט תַּעֲשֶׂה מְעֵשָׂה רַקֵּם: **מ** וְלִבְנֵי אֶהְרֹן תַּעֲשֶׂה כֹתֹנֶת וְעָשִׂיתָ לָהֶם אֲבִנְטִים  
וּמִגְבְּעוֹת תַּעֲשֶׂה לָהֶם לְכָבוֹד וּלְתִפְאֶרֶת: **מא** וְהִלְבַּשְׁתָּ אֹתָם אֶת־אֶהְרֹן אֶחָיד וְאֶת־בְּנָיו אֹתוֹ

Cantillation sign

vowel

Letter  
(consonant)

# Traditional cantillation biblical texts

הַמְעִיל סָבִיב: **לה** וְהָיָה עַל־אֶהְרֹן לְשֵׁרֶת וְנִשְׁמַע קוֹלוֹ בְּבֵאוֹ אֶל־הַקֹּדֶשׁ לְפָנָי יְהוָה וּבְצֵאתוֹ  
וְלֹא יָמוּת: **{ס}** **לו** וְעָשִׂיתָ צִיץ זָהָב טָהוֹר וּפְתַחְתָּ עָלָיו פְּתוּחֵי חֹתֶם קֹדֶשׁ לַיהוָה: **לז**  
וְשִׂמְתָּ אֹתוֹ עַל־פְּתִיל תְּכֵלֶת וְהָיָה עַל־הַמְצַנֶּפֶת אֶל־מֹול פְּנֵי־הַמְצַנֶּפֶת יְהוָה: **לח** וְהָיָה  
עַל־מִצַּח אֶהְרֹן וְנִשָּׂא אֹהֶן אֶת־עֵינֹן הַקֹּדֶשִׁים אֲשֶׁר יִקְדִישׁוּ בְנֵי יִשְׂרָאֵל לְכָל־מִתְנַת  
קֹדְשֵׁיהֶם וְהָיָה עַל־מִצְחוֹ תָמִיד לְרִצּוֹן לָהֶם לְפָנָי יְהוָה: **לט** וְשִׁבְצָתָּ הַכֹּתֶנֶת שֵׁשׁ וְעָשִׂיתָ  
מְצַנֶּפֶת שֵׁשׁ וְאַבְנֵט תַּעֲשֶׂה מַעֲשֶׂה רַקֵּם: **מ** וְלִבְנֵי אֶהְרֹן תַּעֲשֶׂה כֹתֶנֶת וְעָשִׂיתָ לָהֶם אֲבִנְטִים  
וּמִגְבְּעוֹת תַּעֲשֶׂה לָהֶם לְכַבֹּד וּלְתִפְאֶרֶת: **מא** וְהִלְבַּשְׁתָּ אֹתָם אֶת־אֶהְרֹן אַחִיד וְאֶת־בְּנָיו אֹתוֹ

Cantillation sign

vowel

Letter  
(consonant)

- There are structures: six frequently occurring parallel forms---simple, chiasmic, elliptical, sequential, unequal length, and repeated words (Russell, Proceedings of Bridges 2011)
- These structures are not only musical structures, but have connections with the understanding of the text

# Traditional cantillation biblical texts

הַמְעִיל סָבִיב: **לה** וְהָיָה עַל־אֲהֲרֹן לְשֶׁרֶת וְנִשְׁמַע קוֹלוֹ בְּבֵאוֹ אֶל־הַקֹּדֶשׁ לְפָנָי יְהוָה וּבְצֵאתוֹ  
וְלֹא יָמוּת: {ס} **לו** וְעָשִׂיתָ צִיץ זָהָב טָהוֹר וּפְתַחְתָּ עָלָיו פְּתוּחֵי חֹתֶם קֹדֶשׁ לַיהוָה: **לז**  
וְשִׂמְתָּ אֹתוֹ עַל־פְּתִיל תְּכֵלֶת וְהָיָה עַל־הַמְצַנֶּפֶת אֶל־מֹול פְּנֵי־הַמְצַנֶּפֶת יְהוָה: **לח** וְהָיָה  
עַל־מִצַּח אֲהֲרֹן וְנִשָּׂא אֹהֶן אֶת־עֵינָיו הַקְּדוּשִׁים אֲשֶׁר יִקְדִישׁוּ בְנֵי יִשְׂרָאֵל לְכָל־מִתְנַת  
קֹדְשֵׁיהֶם וְהָיָה עַל־מִצְחוֹ תְּמִיד לְרִצּוֹן לָהֶם לְפָנָי יְהוָה: **לט** וְשִׁבְצָתָּ הַכֹּתֶנֶת שֵׁשׁ וְעָשִׂיתָ  
מְצַנֶּפֶת שֵׁשׁ וְאַבְנֵט תַּעֲשֶׂה מַעֲשֵׂה רֶקֶם: **מ** וְלִבְנֵי אֲהֲרֹן תַּעֲשֶׂה כֹּתֶנֶת וְעָשִׂיתָ לָהֶם אֲבִנְטִים  
וּמִגְבְּעוֹת תַּעֲשֶׂה לָהֶם לְכָבוֹד וּלְתִפְאֶרֶת: **מא** וְהִלְבַּשְׁתָּ אֹתָם אֶת־אֲהֲרֹן אָחִיךָ וְאֶת־בְּנָיו אֹתוֹ

Cantillation sign

vowel

Letter

(consonant)

- The signs are organised in well defined structures
- These structures are not only musical structures, but have connections with the understanding of the text

# Different traditions in liturgical music

- Spanish-Portuguese (sefardic)
  - Middle East
  - Germanic countries
  - Central Europe
  - Eastern Europe
- 
- ❖ Influence from the ambient culture
  - ❖ All of them have only divergent branches from a common root.
  - ❖ Researchers identified the roots 3000 years back (King David's period)

# Traditional cantillation biblical texts

אֵל רֹאֵי כִי אָמַרְתָּ הַגִּם הַלֵּם רֹאֵי תִי אֲוֹזֵרִי רֹאֵי  
עַל כֵּן קָרָא לְבִאֵר בְּאֵר לֹחֲזֵי רֹאֵי הִנֵּה בֵּין קֹדֶשׁ  
וּבֵּין בְּרִד וְתַלְדֵּי הַגֵּר לְאֲבָרִם בֵּן וַיִּקְרָא אֲבָרִם  
שֵׁם בְּנֵוֹ אֲשֶׁר יִלְדֶה הַגֵּר יִשְׁמַעְאֵל וְאֲבָרִם בֵּן  
שְׁמוֹנִים שָׁנָה וְשֵׁשׁ עָשָׂר שָׁנִים בְּלִדְתֵי הַגֵּר אֶת יִשְׁמַעְאֵל  
לְאֲבָרִם וַיְהִי אֲבָרִם בֵּן תִּשְׁעִים

The signs and the vowels are not shown in the Torah scroll  
Oral tradition prevails

# Different traditions

- Spanish-Portuguese (sefardic)
- Middle East
- Germanic countries
- Central Europe
- Eastern Europe

All of them have only divergent branches from a common root.

Reseachers identified the roots 3000 years back (King David's period)

[Max Bruch's Kol Nidre, OP. 47](#)

# Audio-visual presentation of biblical text

Text with a very positive atmosphere (joy, happiness, gratitude after Exodus): the scripture expresses stability like the building of a stone wall

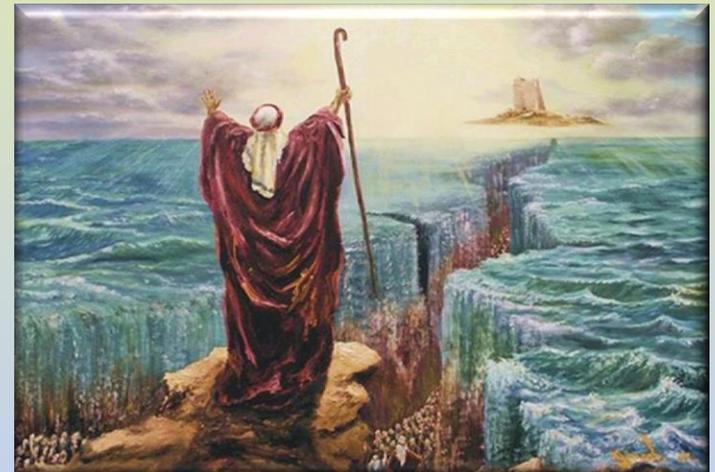
Exodus 15,1

|                       |                  |
|-----------------------|------------------|
| זורה תהלת עשה         | נמכה נאדר בקדש   |
| גזית ימינך תבלעמו ארץ | פלא              |
| גהלת בעזך אל גוה      | בחסרך עם זו גאלת |
| גיל                   | קדשך             |
| אז גבהלו אלופי        | אחז ישבי פלשת    |
| גמג                   | אדום             |
| תפל עליהם אימתה       | כל ישבי כנען     |
| עד                    | ופחד             |

Text with anxiety and lack of hope: the scripture expresses unstability

Deuteronomy 32,1

|                   |                  |
|-------------------|------------------|
| הוא עשך ויכצך     | הלוא הוא אבך קצך |
| בינו שצות דר ודר  | זכר ימות שולם    |
| זקצך ויאמרו לך    | שאל אבך ויגדך    |
| בהפרידו בני אדם   | בהגזל עליון גוים |
| למספר בני ישראל   | ישג גבלת עמים    |
| יעקב חזבל צחלתו   | כי חזק יהוה עמו  |
| ובתהו ילל ישמך    | ימגאהו בארץ מדבר |
| יגרהו כאישון עינו | יסבגהו יגזגהו    |
| על גזליו ירזף     | כשך יעיר קצו     |
| ישאהו על אברתו    | יפרש כנפיו יקחהו |



# Much more than what has been presented here exists



Yoram Raanan

botanics

Song of Songs 8,5  
Under the apple-  
tree I awakened  
thee



geography



שה"ש ח,ה: תחת  
התפוח עוררתִיךָ



**Köszönöm  
Kiitos  
Obrigado  
hvala  
σε ευχαριστώ πολύ  
Thank you  
Merci  
Danke schön  
muchas gracias  
grazie mille  
děkuji moc  
mbardzo Ci dziękuję  
Много благодаря  
большое спасибо  
本当にありがとう  
תודה רבה**