

Evolution of the Interactions between Art and Science: A Bibliometric Approach

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Abstract: The interaction between art and science is an innovative approach to face scientific and social challenges. In this study, the evolution of these interactions was characterized using a bibliometric approach. The results evidence that the scientific publications addressing art and science collaborations as in other research areas increased over time and particularly in the last 20 years. The interactions between art and science evolved from inspiration, communication and instrumentation to other forms impacting on investigation and collaboration

Keywords: Art; Science; Bibliometric; Scientific publications; Citations; Vaccine

1. INTRODUCTION

The multiple interactions between art and science evolved from artistic forms to communicate and illustrate scientific questions and results to methodological proposals and applications impacting on inspiration, collaboration, instrumentation, and investigation [1-9]. The collaboration between visual and musical artists and scientists can not only inspire new scientific questions but may be applied to address these questions to advance in research with impact on science and society [5].

How these interactions evolved is a key question to understand the interest of the scientific community in these collaborations. To approach this question, in this study I used a bibliometric approach using scientific publications that was previously applied to other topics [10, 11]. Bibliometric is part of scientometric research focused on the measurement of the impact of scientific publications with possible applications to advance science and management [10].

2. METHODS

For bibliometric analysis, records of published papers were obtained from PubMed (<https://pubmed.ncbi.nlm.nih.gov/>) accessed on November 20, 2022. The analysis was focused on both visual (painting) and musical (music) arts. The terms used for the query were “painting art” AND “science” NOT Dose painting NOT data visualization NOT neuro scientific visualizations NOT visual examination NOT antiretroviral therapy NOT Assisted Reproductive Technology NOT state-of-the-art, and “music” AND “science” (Figures 1A and 1B). For comparative analysis, queries were conducted separately using terms “vaccine” and “systems biology”. The results were presented as the number of publications per year (Figure 2A). Further analyses were focused on oldest and recent publications obtained from query with terms “painting art” AND “science” (n = 100 for each group of publications; Figure 2B).

To illustrate the evolution in the collaboration between visual arts and science (Figure 3), the following images and pieces were used. Butterfly representation from Don Mariano Torrente, Colección Escogida de Novedades Científicas, Cuadros Históricos, Artículos de Costumbres y Misceláneas Jocosas con el título de Recreo Literario, Imprenta de Jordán, Habana, 1837. Mammal representation from Giovanni Battista Ramusio, Della Navigazioni et Viaggi. Giuni, Italia, 1565. Fossil representations from Miscellanea Berolinensia ad Incrementum Scientiarum, ex scriptis Societati Regiae Scientiarum, Exhibits edita, CVM figvrisaeneis et indicemateriarum, Berolini, Sumptibus Johan, Christ, Papeii, Bibliopolae Regii & Societatis Privilegiati, MDCCX. Surrealistic art piece, Apariciones (Appearances) by Carlos M Luis (Carlos Martínez Luis) (La Habana, 1932 -

Miami, 2013), mixed technique and oil on cardboard, 51 x 41 cm, 1989. Bucina representation from Don Mariano Torrente, Colección Escogida de Novedades Científicas, Cuadros Históricos, Artículos de Costumbres y Misceláneas Jocosas con el título de Recreo Literario, Imprenta de Jordán, Habana, 1837. Dia de Reyes (King’s Day), Album Pintoresco de la Isla de Cuba, Oilprinting Storch & Kramer [for] B. May y Co., ca. 1855. Art piece, Sin título (No title) from the series Mitos (Myths) by René Portocarrero (César Modesto de la Caridad Portocarrero Villiers) (La Habana, 1912-1985), Guaché on paper, 34 x 20 cm, ca. 1950-1960. All pieces courtesy of KGJ Collection, Ciudad Real, Spain.

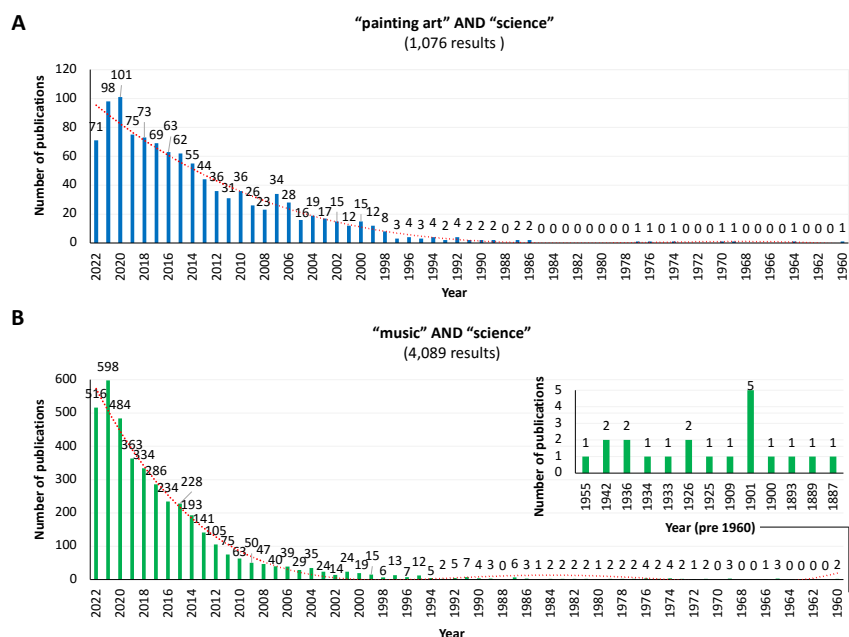


Figure1. Bibliometric analysis using records of published papers obtained from PubMed accessed on November 20, 2022 (Part 1). The terms used for the query were (A) "painting art" AND "science" and (B) "music" AND "science". The total results and number of publications per year are shown and disclosed for each year.

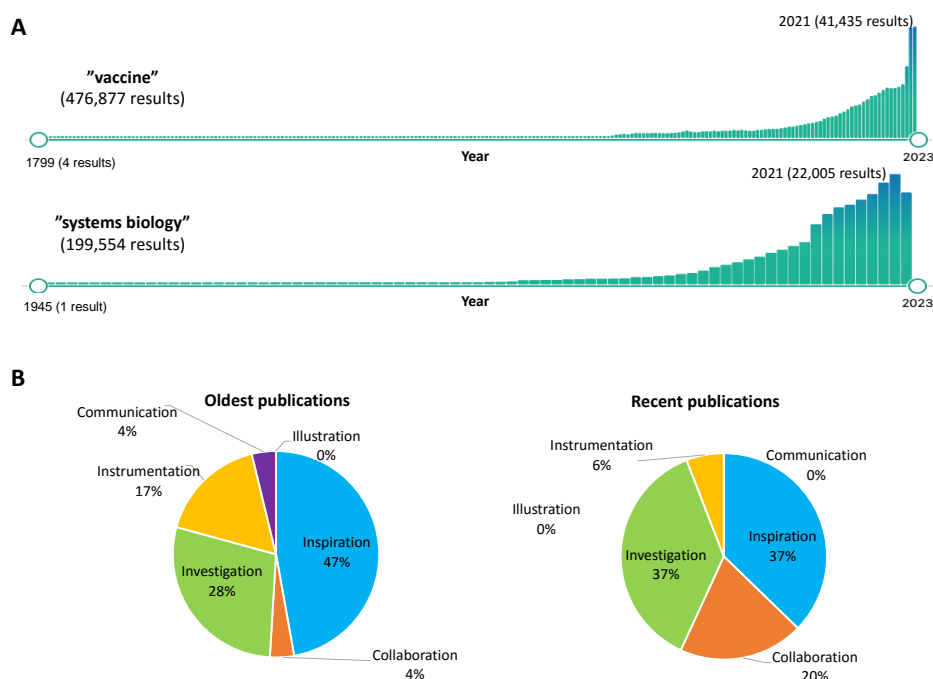


Figure2. Bibliometric analysis using records of published papers obtained from PubMed accessed on November 20, 2022 (Part 2). The terms used for the query were (A) "vaccine" and "systems biology". The total results and number of publications per year are shown and disclosed for 2021 yr. (B) Oldest and latest publications obtained from each query with terms "painting art" AND "science" and "music" AND "science" in Figure 1 (n = 100 for each term) were used for analysis.

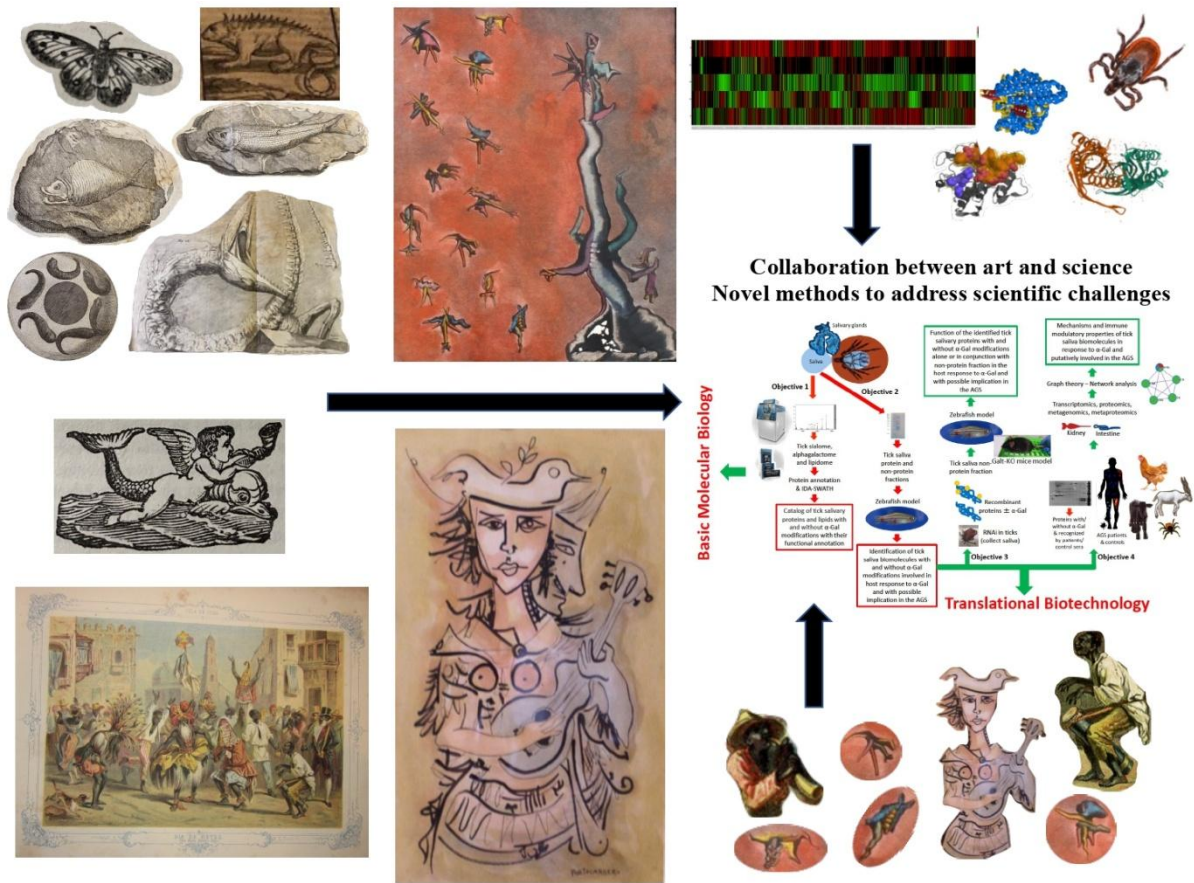


Figure 3. Evolutionary workflow of interactions between art and science with increasing impact of translating collaborations into novel methods and projects to address scientific and social challenges.

3. RESULTS AND DISCUSSION

Interactions between visual and musical art representations and science occur in multiple forms impacting on inspiration, collaboration, investigation, instrumentation, communication, and illustration [7]. Inspiration refers to how art inspires scientists by raising research questions with experimental and social implications [6]. Collaboration includes how musicians and visual artists collaborate with scientists to face scientific challenges through novel methods [5]. Investigation is how artistic representations challenge and inspire scientists to apply scientific approaches to address investigations in art [12]. Instrumentation addresses the development of methodological approaches to face scientific questions through the collaboration between scientists and artists [6, 9]. Communication is how multiple collaborations contribute to communicating to the public the challenges faced by science and society and results derived from research projects [3]. Illustration is the use of art pieces to illustrate scientific publications [13].

The results of the bibliometric analysis evidence that the scientific publications addressing collaborations between visual and musical art manifestations and science as in other research areas increased over time and particularly in the last 20 years (i.e., about 10% of the publications appeared in 2021) (Figures 1A, 1B and 2A).

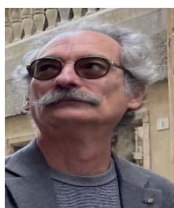
The analysis of the evolution of art and science interactions showed that inspiration, communication, and instrumentation were higher in oldest publications (e.g., [14-16]), while investigation and collaboration increased over time and are higher in recent papers (e.g., [5-7, 17-19]) (Figure 2B). These results suggest that the interactions between art and science evolved from inspiration, communication and instrumentation to other forms with increasing impact on investigation and collaboration. Communication using artist contributions has probably increased but in publications not registered in PubMed.

In conclusion, the results of the study support a role for collaborations between artists and scientists to advance in facing scientific and social challenges and highlight the increasing impact of translating these collaborations into novel methods to address these challenges (Figure 3).

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