THE DAWN OF DIGITAL SHEET MUSIC: A LOOK AT NEOSCORES

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English Abstract
Many digital innovation efforts approach the challenge of transforming a traditional product as primarily technological, in the belief that a digital product can simply replace an existing traditional one. The high adoption rate of tablets potentially offers new opportunities for the sheet music market and creates the promise of a digital breakthrough in this traditional industry. However, simply developing an application with a snazzy design will not convince musicians to adopt digital sheet music, as they demand consistent usability. In this article we investigate how NeoScores, an intriguing startup, handles many challenges of innovating sheet music. The three founders are experienced musicians and regretted that many industries and products were successfully digitalizing except for sheet music. We will study how NeoScores invests time and effort in technology development, in balancing the traditional sheet music culture and in meeting the requirements of musicians.

French Abstract
Beaucoup d'efforts d'innovation numérique abordent le défi de transformer un produit traditionnel d'un point de vue principalement technologique, en croyant qu'un produit numérique peut simplement remplacer un produit traditionnel existant. Le taux d'adoption élevé des tablettes numériques offre de nouvelles opportunités pour le marché des partitions et pourrait conduire à une percée numérique dans cette industrie traditionnelle. Toutefois, simplement développer une application avec un design tape-à-l'œil ne convaincra pas les musiciens d'adopter le format numérique étant donné qu'ils exigent une utilisabilité constante. Dans cet article, nous examinons comment NeoScores, une jeune entreprise remarquable, relève les défis que posent les partitions numériques. Les trois fondateurs sont des musiciens expérimentés et regrettaient que les partitions, contrairement à plusieurs industries et produits, ne soient pas encore passées avec succès à l'ère du numérique. Nous allons étudier comment NeoScores investit temps et efforts dans le développement technologique afin de répondre aux exigences des musiciens tout en tenant compte de la culture des partitions traditionnelles.

German Abstract
Viele Versuche digitale Innovationen hervorzubringen gehen die Herausforderung, ein traditionelles Produkt zu transformieren, primär technologisch an, und zwar im festen Glauben, dass ein digitales Produkt ein existierendes traditionelles Produkt einfach ersetzen könne. Die hohe Verbreitung von Tabletcomputern bietet potenziell neue Möglichkeiten für den Musikalienmarkt und verspricht den digitalen Durchbruch in dieser Traditionsbranche. Es wird jedoch nicht ausreichen, einfach eine schicke Anwendung zu entwickeln, um Musiker von der Nutzung digitaler Musikalien zu überzeugen, da diese nachhaltige Nutzungsmöglichkeiten verlangen. In diesem Artikel wird untersucht,

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wie das bemerkenswerte Startup-Unternehmen *NeoScores* sich den Herausforderungen der Erneuerung des Notendrucks stellt. Die drei Gründer sind erfahrene Musiker und bedauern allesamt, dass viele Branchen und Produkte - nur nicht der Notendruck - erfolgreich ins digitale Zeitalter gekommen sind. Es wird untersucht, wie *NeoScores* Zeit und Energie in die Technologieentwicklung sowie in die Rücksichtnahme auf die traditionelle Notenkultur investiert und zudem auf die Ansprüche von Musikern reagiert.

Introduction

The audience of the Brussels Philharmonic might be forgiven for thinking that something was seriously amiss on the seventh of November 2012. The age-old image of orchestra members shuffling and adjusting music scores was replaced by the slick swiping movements normally associated with tablet games. The audience need not have feared: in a bold move, the Brussels-based orchestra had decided to hold a one-off concert using digital sheet music. While the performance did draw attention to the orchestra—always on the lookout for ways of distinguishing itself from its peers—it mainly confirmed the hopes of digital sheet music advocates that a full-scale concert using the technology is possible. The orchestra's director, at the same time, emphasised that the experiment was just that. While digital sheet music saves tremendously on paper and manual labour, it does present both orchestras and software engineers with a number of challenges.

What will it take to have a mature digital sheet music experience? The field is teeming with projects from diverse companies. R&D institutions are beginning to grasp how they can build digital libraries, which enhances access and functionality and facilitates scholarly research and education. As electronic devices increasingly make their way into the classroom, more and more voices, both teachers and pupils, cry out for digital sheet music.

A few lone missionary musicians aside, however, the music community has not fully embraced digital sheet music into its musical experience. Most orchestra music, for instance, is still distributed via paper rental from publishers, composers, or agents who have ownership. All sets are returned to their owners upon finalization of the contracted use. When viewed from a distance, this entire process seems to run counter to the creativity inherent to music, transforming it into a cumbersome, almost administrative process. Additions and annotations to musical compositions made by conductors and musicians need to be taken to the orchestra's archivists and manually copied into the scores of selected orchestra members: a process which not only is intense in terms of time and resources but also prone to mistakes, with musicians not hearing conductors' remarks, misinterpreting them, omitting to note them down, or crossing them out.

Experiences such as these led three musicians to found neoScores, with the aim of introducing digital sheet music in music practice in general – not just orchestras: *"Whether you play for a rock band, a choir or an orchestra, sheet music is always a fuss."*

The Origins of neoScores

Some years ago, a late-night conversation in a bar in Antwerp, Belgium, saw Bob Hamblok, a tech-guy with a love for and professional knowledge of music, and Jonas Coomans, a professional and highly-engaged contrabassoon player, discuss the evolution of the digital age in general and the possibilities for sheet music in particular. Both were struck by the sad state of sheet music when presented on the screen of a laptop or indeed

any other device. At the time, sheet music was presented either in print or, when "digital", in a PDF format. Either option left much to be desired in terms of interaction and manipulation. Two years passed in which Hamblok and Coomans consistently developed, tested, and adapted their neoScores software in order to display what they defined as digital sheet music. The exponential technological evolution, however, almost ended their innovative endeavour. Apple's iPad, launched in 2010, was hailed as a promising digital sheet music carrier through its light weight, ease of use, and advanced audio- and microtechnology. The iPad challenged the two entrepreneurs to re-develop and re-design neoScores into an interactive application.

The project acquired true momentum when Bart Van der Roost, production leader of the Brussels Philharmonic, joined the team: he initially kept up informal contacts with Hamblock and Coomans to remain up to date with evolutions in the field of digital sheet music, but his knowledge of the publishing market was instrumental for neoScores' development. In mid-2012, Van der Roost asked the two men to co-operate on an innovation project of the Brussels Philharmonic, which aimed to develop a "paperless concert". Samsung delivered the tablets, while Hamblok and Coomans refined the software. The project proved that it was indeed possible to read the most complex of sheet music, the kind required by a professional, 90-piece orchestra, on a digital device. For Van der Roost, Hamblock and Coomans, the successful experiment proved the catalyst to fully commit themselves to the neoScores project.

Hence, neoScores exemplifies how innovation often originates with those who create solutions for their own needs. All founders had studied an exhaustive amount of music from sheet music and played hours of music by reading sheet music. "*We are all three masters in music, Bob is also a web developer. We were very much annoyed by the fact that the whole world was digitalizing except our sector."* As such, as musicians they gained a deep understanding of their unmet needs and had the incentive to finds ways to fulfill them.[2]

A Digital Transition in Sheet Music.

Sheet music is a mature product to display music notation which has grown over hundreds of years. This has resulted in a very consistent and reliable product. Sheet music can be issued in many different formats, ranging from an individual piece for a popular song, or as a collection of works by an artist or band. It is a way of notating sound which helps to learn aspects of music which are not always obvious from listening. Sheet music is not only used as a prescription, but also as a sort of sketch book in which the musician writes down personal marks, newer compositions or specific adaptions.

Yet, the nature of sheet music in combination with the emergence of more mature technology might devaluate printed music. From a musician's standpoint, having a pile of sheet music is simply inconvenient. Making sense of the pile demands extensive organization and filing. Moreover, printed music is subject to decay or damage as paper is inherently frail. As such, it is not uncommon for musicians to copy or scan sheet music into PDF files and store them digitally as a backup. From a publisher's standpoint, the ease with which current technology allows copying and sharing places printed music under considerable stress. An additional challenge is presented by the rapid increase of unli-

2. von Hippel, E. 2001. Innovation by user communities: Learning from open-source software. MIT Sloan Management Review, 42(4): 82–86. The concept of user innovation is well described in business literature and was first introduced by von Hippel.

censed websites which distribute free, user-generated sheet music. The internet has facilitated sharing and recreation of sheet music on an unprecedented scale and while those action are often defined as illegal and threatening, they also underline the high value placed by musicians on instant access and on the availability of enormous catalogues.

NeoScores' software is twofold. Firstly, it offers an application that does not need to be downloaded, that can be accessed by a musician from any device (computer, tablet or mobile phone), and that displays the sheet music not as a picture, but as a dynamic, interactive file. Simply put, the musician needs to see his digital sheet music as a dataset, not as a graphical representation. The software can add dynamic elements like colour, width, height, local lyrics, educational aids and multimedia. Additionally, neoScores offers a digital sales channel for owners of sheet music content. In the same way that Apple opened its iTunes store after striking agreements with the five major record labels, neoScores wants to become an online distributor of digital sheet music. In order to obtain the licensing agreements, it guarantees the files offered via the digital sales channel will be protected against illegal sharing. As such, neoScores never allows an actual download. The product only grants access to a temporary file which is protected.

Challenges in Digital Transition

A closer look at the case reveals how neoScores does not only design the software, but how the company aims to develop a systemic approach to digital transition. Many difficulties in digital sheet music adoption can be traced back to the fundamental error of focusing on the product rather than the whole. Analysing neoScores helps us when trying to unfold some of the many interdependent components in the system of digital sheet music. In specific, the remainder of this article aims to shed light on an enabling technology, on musicians' requirements and on a balance with the traditional sheet music culture.

Enabling technology.

Digital sheet music is not a stand-alone product. Throughout the last 30 years, digital sheet music has become more and more functional and desirable through the emergence of a set of *complementary goods* available. Music notation software, for instance, allowed musicians to input and edit sheet music digitally. The evolution in computer devices, especially the introduction of tablet computers, allowed for more and more layers in the digital sheet music experience by incorporating audio and video. Even more, the current presence of cloud-computing opens up new dimensions in terms of sharing digital sheet music.

The display of digital sheet music, too, is maturing. In its childhood, it mainly consisted of PDF-files featuring little more than the option for printing, basic annotations and the exportation of those annotations to other devices. The recent generation of digital sheet music, however, features more interactivity, such as listening to music playing back in synchrony with a scrolling display. Additionally, more virtual formats (e.g., standard MIDI file, audio (wav, mp3) and MusicXML export) have become possible. These new digital formats allow many manipulations such as instrument changes, transposition, MIDI playback, and they are somewhat interchangeable across different devices.

Although digital sheet music has many advantages in terms of technological possibilities, developing a level of standardization which allows digital sheet music to be shared across different devices and amongst different users as easily and reliably as a PDF or paper file has been a challenge. Therefore, neoScores actively supports the most general

digital standard in the field, MusicXML[3]. The company argues that the whole field benefits from creating a stable common architecture in digital sheet music. The sooner the music community arrives at a dominant design, the faster the development of new technological advantages. Paradoxically, constant technological evolution means that the – admittedly great – MusicXML file format is subject to continuous maintenance and improvement, thereby adding to the neoScores workload.

Musicians' requirements.

Musicians use sheet music in many different ways, and some of the preferences are deeply embedded in their behaviour. Many musicians, moreover, might have difficulty understanding the technology and its role in their life. Consequently, neoScores and many other digital sheet music projects may face considerable ambiguity about the importance of various features of the technology. Therefore, neoScores has taken two interesting steps to better grasp the requirements. First, based on a survey of 1500 musicians, the team surprisingly found out that musicians do not always appreciate the "bells and whistles" in digital sheet music. Rather than having a huge number of functions in terms of annotations, score following, audio and video, the musicians first and foremost expect very "clean" digital sheet music and appreciate quality similar to the paper alternative. This finding complies with an often recurring phenomenon in digital products: the rate at which a technology improves over time is often faster than the rate at which user requirements increase over time. This phenomenon implies that technological inventions in the area of digital sheet music might reach further than musicians anticipate right now. It promises a technological utility far beyond the present use of sheet music. Second, neoScores has set up a beta-testing stage a priori to launching the product in order to improve the digital performance and to clear the bugs from the project. This does not only result in a more stable technology but also allows the team to observe the interaction of a musician with the product and to make choices based on those observations.

Studying musicians' requirements and investigating their feedback might help to uncover the considerable uncertainty about the product features desired by customers, but in many technological projects this feedback might not be enough. People, managers and entrepreneurs in many different areas of digital innovation testify how "pointless" or "difficult" it is to understand a new product in the relation with its users because "you can't tell how people are *going* to behave based on how they *have* behaved". Hence the famous quote by Henry Ford "*If I'd asked my customer what they wanted, they'd have said a faster horse*". It seems, therefore, that people don't truly know whether they want a new product until it already exists[4]. They may be intrigued by the ingenuity of a new idea, but won't have enough familiarity with the product and how it might affect their current habits or routines to predict whether they will really adopt or buy it at the end of the day. This paradox might have a considerable impact on the development process of digital sheet music. The most practical and effective course in situations of high ambiguity is to take an emergent approach – that is, to make your best predictions about what will work and then fo-

3. MusicXML was designed for sharing sheet music files between applications, and for archiving sheet music files for use in the future. MusicXML files aim to be readable and usable by a wide range of music notation applications.

4. Gerald Zaltman, 'Hidden minds: When it Comes to Mining Customer's Views, We've Only Scratched the Surface,' *Harvard Business Review*, vol. 80/6 (2006), 26–7

cus on creative and quick ways to test the assumptions underlying those predictions. This is good advice for new projects in general, and it applies to systemic transitions as well.

Balancing the traditional sheet music culture.

neoScores needed to find a way to position itself in the traditional sheet music culture. A licensing agreement may be used to offer musicians legal digital content while offering composers and sheet music publishers copyright protection in a digital setting. The team, however, tries to define a much stronger competence-enhancing role for traditional sheet music publishers. neoScores attempts to answer musicians' demands for high quality – a demand well understood by the publishers of traditional sheet music. The publishers have an eye for detail and have built a strong network with musicians. neoScores defines its technological role as an addition to this core expertise. As such, they have been focusing their product development by explicitly incorporating the art of publishers' engravers. They acknowledge how those traditional rules, which have evolved over many years, might remain considerably valuable to musicians. Establishing a level of integration, however, is an intense and hard exercise and reaching a balance between tradition and new technologies is not without its burden. Technology change, after all, does have an impact on the way different actors in the traditional sheet music culture (whether they be companies, research institutions or orchestras) view themselves.[5]

Conclusion

This article discussed some particular components which are related to the further transition in digital sheet music. The intention was to open a debate and is by no means intended to be normative and exhaustive. One can easily imagine the interplay of other important components such as educational policies or orchestra regulations. It may be quite impossible to predict what digital sheet music technology will look like eventually. All actors, however, benefit from some level of experimenting to generate momentum. It may be natural to think that systemic transitions in digital sheet music start with technology and that musicians and content owners step in later. The neoScores case indicates that the components needn't be conceived in a particular order. Indeed, the collaboration with Brussels Philharmonic has shown that other actors besides software engineers can take up a pioneering role.

Systemic transition is hard. In management, it is named "the biggest of big bets" involving many interdepencies and often more than a little luck. It is not surprising, therefore, that there are not many examples of successful digital sheet music, and that the ones which exist are still much criticized. Focusing only on the risks and the shortcomings, however, will blind us to the lessons we can learn from pioneering efforts such as neoScores. Going by the thunderous applause received by the Brussels Philharmonic on the seventh of November 2012, we might do well to take note.

5. Sarah Kaplan, and Mary Tripsas, "Thinking about Technology: Applying a Cognitive Lens to Technical Change,". *Research Policy*, vol. 37 (2008), 790–805. Mary Tripsas, and Giovanni Gavetti, "Capabilities, Cognition, and Inertia: Evidence from Digital Imaging," *Strategic Management Journal*, 21 (2000), 1147–1161. Mary Tripsas, PhD (Carroll School of Management, Harvard Business School and the Wharton School) has indicated in many studies that, although organizations often see the value of a technological change, the operational change is often inhibited because the new technology challenges the core of how an organization views itself. The author has studied this phenomenon of identity impact and inhibition in many fields such as the transition from analogue to digital imaging.