7. Changing gears
Fast-lane design for accelerated innovation in memory organizations

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Audiovisual archives are embracing the opportunities offered by digitization for managing their work processes and offering new services to a wide array of user groups. Organization strategy, working processes and software development need to be able to support a culture where innovation can flourish. Some institutions are beginning to adopt the concept of 'two-speed IT'. The core strategy aims to accommodate two informational technology tracks simultaneously: foundational but 'slow' and innovative but flexible and 'fast'. This paper outlines the rationale behind the two-speed IT strategy. It highlights a specific implementation at the Netherlands Institute for Sound and Vision, a large audiovisual archive and museum where two-speed IT is enabling the institute to reach its business objectives.

Museums benefit from fostering a 'culture of innovation' as a way to effectively manage ever-changing expectations of user groups and, at the same time, make the most of new opportunities offered by technology (Simon, 2011). The fundamental challenge is how to achieve the public missions (i.e. supporting a myriad of users in utilizing heritage collections so that they can actively learn, experience and create). As Douglas

Rushkoff (2014, p. 70) notes, "It's not about how digital technology changes us, but how we change ourselves and one another now that we live so digitally". For this, it is essential for museums to have access to technical infrastructure that not only allows for digital assets management but also helps them to pursue contemporary objectives (Johnson *et al.*, 2015). For instance, museums can use new channels for content distribution (e.g. YouTube, Instagram) to engage with new user groups or employ technologies (e.g. linked open data, natural language processing) to enrich and optimize work processes or to encourage creative ways to access collections (Gorgels, 2013).

In this paper, we propose the fostering of innovation for heritage organizations through deploying 'two-speed IT' (Bossert, Harryson and Roberts, 2015) and the accompanying organizational structure to realize it.

Fostering a 'culture of innovation'

Archives differ from organization to organization. Some organizations are established by law as separate entities (legal deposits); others are part of larger organizations like museums, libraries, universities or broadcasters. In many cases, audiovisual collections are maintained by public bodies and in effect serve public missions, but not exclusively. Commercial footage libraries and other commercial entities (e.g. search engines and video platforms) are also looking after growing bodies of audiovisual heritage, albeit with primary motivations other than providing access to support knowledge sharing or creative processes. Another area of growing importance is private archives, notably created by the billions of people carrying smartphones that allow for high-quality multimedia recording. Personal archiving is starting to be addressed (Redwine, 2015), but it is an area that demands much more research. Established archives are investigating to what extent they can help ensure long-term access to these collections. Many commercial players are active in this domain, from social networks to cloud storage providers. Given this context, it is key for 'traditional' archives to educate their constituents about the value they bring to society not only through securing the sharing of knowledge,

a prerequisite for democracies to function, but also, and perhaps more down to earth, through educating and entertaining communities and individuals and through facilitating the exchange of ideas among various stakeholders.

Over the past years, we have participated in many online and offline discussions in the audiovisual archives domain. Below are some of the main subjects that will affect these archives' future position, given the context in which they operate.

Foremost, audiovisual archives are in a challenging position, operating as custodians of (mostly) in-copyright works while also managing the public's expectations in providing online access. Copyright rules need to be modified to allow memory organizations to provide access to their collections. A balance needs to be found between giving creators remuneration for using their works and allowing the guardians of their works to provide public access for various user groups. As a fundamental rule, content added to the public domain should stay in the public domain (Communia, 2011). Also, memory organizations should consider adopting an 'open by default' access policy in order to lead by example. Also, archives could consider liaising with rights owners to study the possibilities for providing access to commercially unviable (i.e. out-of-commerce) content under few constrictions (European Commission, 2012). Modernization of copyright regulations should look into collective licensing and other ways to decrease the burden for obtaining copyright permissions. With respect to newly created material, creators should be encouraged to use Creative Commons licenses to foster a culture of innovation and creativity. For works commissioned by public institutions, the use of open licenses could be made compulsory (European Commission, 2015).

Impact needs to be measurable and measured wherever and whenever possible, not only to ensure that archives remain accountable for how resources are spent but also to build solid business cases that will enable future investments, be they in services or supporting infrastructures. Following the balanced value impact (BVI) model, we can distinguish between *internal*, *innovation*, *economic* and *social* impact (Tanner, 2012). Impact metrics also need to take into account new types of use. Already, material from archives is shared using open licences (e.g. on platforms such as Wikipedia) (Brinkerink, 2015). Use on these third-party platforms needs to be monitored if possible; alternatively, qualitative evidence needs to be gathered. Audio and video fingerprinting can be used to track content usage over various platforms.

As a result of digitization, archives and their users are sharing the same information space. To fully realize their potential, archives need to ensure that their collections are available where users reside. A practical implication of this truism is that institutionally maintained access points such as searchable archive catalogues should not be the only way to access collections. On the web, content likes to travel, and archives must embrace this fact, at the least by making their catalogues findable for online search engines and shareable on social media platforms. More fundamentally, they should provide developers with application program interface (API) access to the catalogue and content and adopt machine-readable copyright labels to facilitate access (Chan and Cope, 2015). In this way, third parties can 'build upon' online collections (e.g. publishers that integrate resources in learning environments). Following this 'liberalization' of content, a new paradigm emerges that allows archives to focus their efforts on 'super serving' niche communities such as filmmakers, media scholars and amateur historians.

Archives benefit from fostering a 'culture of innovation' as a way to effectively manage ever-changing expectations of user groups and, at the same time, to make the most of new opportunities offered by technology (McKeown, 2012). For this, it is essential for archives to have access to technical infrastructure that allows not only the management of digital assets but also the pursuit of contemporary objectives in line with user expectations. For instance: using new channels for content distribution such as YouTube and Instagram to engage with new user groups, using technologies such as linked open data and natural language processing to augment and optimize work processes or allowing for creative ways to access collections. A 'culture of innovation' will also open possibilities to increase the level of cooperation with academia in areas ranging from digital humanities to computer science.

Two-speed IT in the heritage domain

Bossert, Harryson and Roberts (2015) outline how organizations need to have capabilities in four distinct areas in order for them to remain successful as their operations and services are increasingly digitized. In order to deliver services on a timely basis, software development of "testing, failing, learning, adapting, and iterating rapidly" needs to be in place. However, applying an 'experimental' development approach in an operational context that includes critical back-end (legacy) systems is hardly possible, nor is it appropriate. As a way to cope with this fundamental incompatibility, organizations can choose to adopt a digital product management model, coined 'two-speed IT'. This accommodates two tracks, or 'speeds', simultaneously: a 'slow' foundational speed and a 'fast' innovative speed. Below, we consider how the concept may be used in the heritage domain.

Managing digital assets and embracing innovation are characterized by very different dimensions in the heritage domain. In terms of standards used, partnerships, managing investments over time, accountability, staff expertise and more, the issues and demands are different than at other organizations.

For the 'slow' speed, standardized and off-the shelf solutions are used to secure 24/7 service. The solutions are updated following service-level agreements with suppliers. In the heritage domain, good examples are systems for managing storage, cataloguing, play-out and ordering. Given the impact, the frequency of updating applications in the 'slow' ecosystem is measured in months or years rather than weeks.

The 'fast' speed features mostly tailor-made solutions that cater to very specific user requirements and are used to experiment with new technologies. Opposed to systems that are 'core' (for instance the storage systems), applications developed in the 'fast' speed do not have very stringent requirements regarding stability and minimum 'uptime' (i.e. they are in some cases maintained by developers themselves). For instance: experimental visualizations of data sets, automatic metadata extraction services and online magazines linked to current exhibits. This is the 'speed' most closely connected to creating highly personalized experiences (Rodney, 2016).

Both ecosystems have their specific infrastructures, applications, development and staging environments, as well as suppliers. They overlap partly, for instance when ecosystems make use of similar underlying streams of data (Fig. 1). In practice, the 'conversion' from slow to fast is a process driven by business requirements. What is key is to optimize systems and processes.

Our illustrative use case is the Netherlands Institute for Sound and Vision. Sound and Vision is a leading audiovisual archive with a growing digitized collection of 1.9 million objects (ranging from film, television and radio broadcasts to music recordings and web videos) and a museum that attracts approximately 250 000 visitors annually. Born-digital assets are ingested in a state-of-the-art digital repository accessible both online and in the museum. A source of inspiration is the API-driven technology 'stack' of the Cooper Hewitt museum in New York, enabling innovative ways to unlock the collection database in use, both online and on site (Chan and Cope, 2015). The stack of the Cooper Hewitt connects two proprietary servers: the collection database (TMS) and the database that knows about the visitors. These servers are positioned in the 'slow' speed ecosystem. An API allows the creation of a range of software applications, including the website and the interactives in the exhibits. As Meyer (2015) notes, "the [Cooper Hewitt] museum made a piece of infrastructure for the public. But the museum will benefit in the long term, because the infrastructure will permit them to plan for the near future".

Two-speed IT in practice

Sound and Vision has ensured the successful transition to the digital domain after completing a seven-year, EUR 90 million programme to digitize its analogue assets. Today, it has one of the largest collections of digital heritage assets in the world, totalling over 15 petabytes. Recently, a multiannual innovation agenda was adopted, consisting of five research themes: (1) develop automatic metadata extraction and big data analysis, (2) explore new access paradigms, (3) understand users, (4) ensure digital durability and (5) study the impact of media. An integral part of the transition to the digital domain, a new mission statement, a new strategic plan (covering 2016 to 2020) and a new organizational structure were defined and implemented.
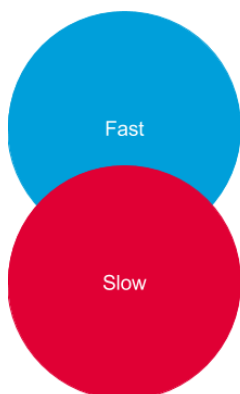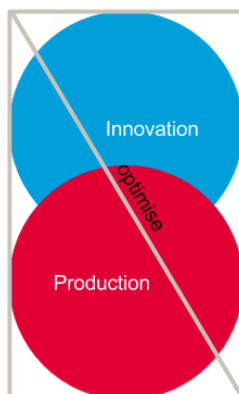
FIGURE 1. Two-speed IT ecosystems.

A guiding principle was the conviction that the success of memory organizations lies in their ability to make the above-mentioned notions of 'smart', 'connected' and 'open' integral parts of their strategies (Oomen and Aroyo, 2011; Ridge, 2014). Sound and Vision adopted two-speed IT as one of the key design principles.

Before implementing two-speed IT, software development had been mainly executed by third-party software developers. Also, there were few formalized connections between research and development (R&D) and the rest of the organization, making it hardly possible to implement results from R&D in daily operations.

Hence, two-speed IT needed to be grounded also in the organizational structure. Today, three departments are jointly responsible for delivering successful IT solutions: R&D, Development, and Production and Maintenance (Fig. 2).

The departments have the following responsibilities:

1. R&D: implementing the research agenda through participation in research projects. Software development by scientific programmers.
2. Development: translating business requirements into functional requirements; evaluating output of R&D projects; creating services and applications that foster and adopt innovation. Development following SCRUM.
3. Production and Maintenance: ensuring the uptime of applications; installing new versions and patches from third-party suppliers according to set service-level agreements.

Small and medium enterprises (SMEs) also play a key role; they are partners in R&D programmes and are involved in the successive stages. It needs to be noted here that even though software is created in the 'fast' speed, resulting

solutions can be put in production and maintained by SMEs under the terms for a service-level agreement.

Note that the three departments are not responsible for the business requirements and product ownership of the services developed. The business units, Archive (responsible for the collection management and access) and Museum (operating the Sound and Vision museum and online presentation), are responsible for this.

Handling of the flow and resources between the teams will be addressed by adopting the concept of (living) labs that allow Sound and Vision to experiment and explore innovative concepts in a near-production environment, in close-to-real-life scenarios with realistic data sets. As we require the labs to be based upon production system infrastructure and protocols, the uptake of successful concepts in the production environment can be much smoother. Obviously this requires close tuning and synchronization between the three departments involved.

First adoptions: speaker labelling and entity extraction

At Sound and Vision, an off-the-shelf asset management system (Digital Audiovisual Archive Netherlands, DAAN) from supplier Vizrt forms the foundation of the 'slow' ecosystem (Vizrt, 2015). The asset management is the 'core' of the archive and includes services to search, view, select, license and order digital media assets. Next to DAAN is a more agile 'fast' ecosystem of tailor-made solutions for distinct functionalities, notably open source search and automatic metadata extraction. This is the layer where output of research can be implemented in production workflows.

Following the two-speed IT, Sound and Vision successfully deployed automatic speaker labelling (a result from a research project with Radboud University) in 2014, speeding
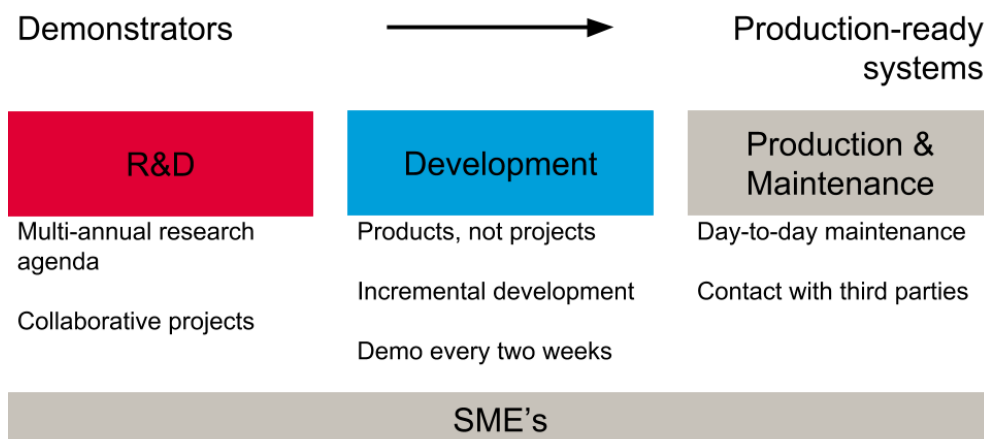

FIGURE 2. Departments working on two-speed IT at the Netherlands Institute for Sound and Vision.
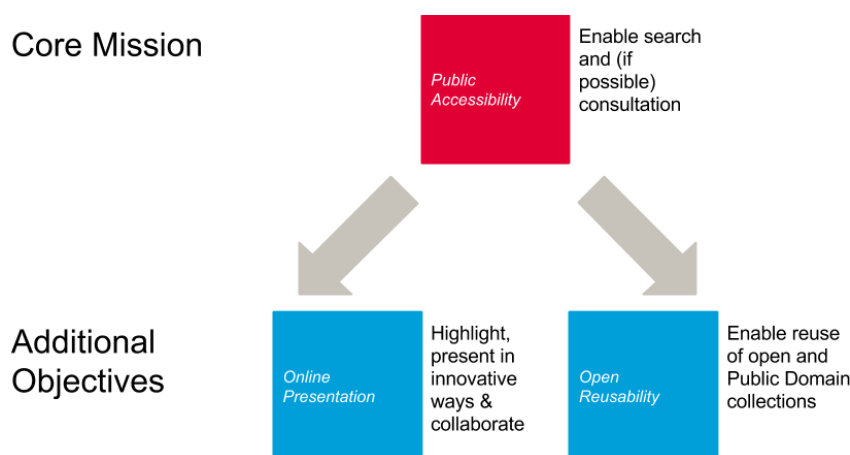
FIGURE 3. Schematic overview of the three forms of online availability.

up the annotation process and offering a new access point to the collections. In 2015, technology to extract names of people, places, events and organizations from subtitle files was introduced. This was originally developed in collaboration with the University of Amsterdam. In both cases, spin-off companies from universities are playing an important role in the process, as they were involved in developing the initial demonstrators with academics and currently are working under a service-level agreement with the Production and Maintenance department.

Conclusions

Heritage institutions can consider adopting 'two-speed IT' to enable innovation in parallel to maintaining a stable core digital infrastructure. The Netherlands Institute for Sound and Vision has adapted the two-speed approach to enable it to innovate with new technology while maintaining a stable, standardized basis for IT infrastructure. This has had an impact on the strategy and organizational structure of the institute. Following the implementation of this approach, cutting-edge speaker identification and automatic entity-extraction techniques were successfully implemented in production systems in 2014 and 2015. This year, an ambitious programme on online access has been initiated through an innovation agenda.

Over the past two years, we have learned a lot regarding two-speed IT and have found it to be a well-suited strategy for ensuring that the outcomes of research and innovation projects can find their way to production systems. With the experience gained over the past years, we look forward to implementing the new access strategy and further developing the two-speed IT model within our own organization. We hope other museums and memory organizations think about creating and maintaining the technical prerequisites to flourish in an online networked environment.

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