TROMPA

TROMPA: Towards Richer Online Music Public-domain Archives

Deliverable 8.6

Progress/Interim Report

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Executive Summary

This deliverable aims to reflect the work status and main scientific achievements of the project during the second year, through a progress report from month 13 to month 24 that includes the work carried per work package, dissemination and exploitation activities and use of resources in terms of person month consumed.

The objective of the deliverable is to provide an update of the project, highlighting the achievements and deviations that we have encountered during this second year of the project.

Regarding **WP1**, for the 2nd year UPF has received ethics approval for the planned user interactions in May 2019 while TUD has a different ethics approval procedure: applications and approvals are to be made per experiment, and cannot be made in advance for a complete project. Regarding ongoing experiments (e.g. crowdsourcing microtasks), an application has been sent and granted. GOLD is on the process of iterating their ethics application with their local committee.

WP2's main focus was on elicitation and prioritisation of the requirements for target user groups. Final requirements for user pilots have been developed and the corresponding technical requirements have been aligned with them. The process of requirements elicitation from user communities for sustainable exploitation opportunities beyond the project term has been initiated.

WP3 continued focusing on developing technologies related to music description. We investigated the current state-of-the-art technologies for music description and processing that are relevant in the scope of classical music and in the context of the different TROMPA pilots, further developed them, as well as incorporated new . In addition, we defined the target repertoire and the corresponding repositories that are to be exploited in the TROMPA use cases.

WP4 achieved its planned results, which included the refinement and further extension of 1st year's efforts on a) the development of models for the representation of relevant properties of crowd contributors (D4.2); b) the design of incentivisation mechanisms for crowd contributors (D4.3); c) the design and development of hybrid workflows combining the crowd with the automatic processes of WP3 (D4.4); and d) the design of the building blocks of a framework for the continuous evaluation and improvement of technologies in WP3.

Regarding **WP5** both the shared CE infrastructure and the individual components have evolved significantly during this period. New functionality has been added across all parts. The components have been refined based on the more specific needs of the user pilot applications of WP6 that will integrate these components. The shared CE has been brought from the initial state to a more robust production environment. The CE-API has been updated multiple times during this period, with a major release before the M20 internar deadline incorporating all needed functionality for the WP6 user pilots and including the neo4j-graphql-js framework to simplify integration of the CE functionality in other components and applications.

Following the requirements specified under WP2, the research conducted under WP3-4 and the foreseen common infrastructure under WP5, the work under **WP6** focused on concretizing and integrating insights and achievements from WP2-6 into user-facing pilots, targeting the five target audiences in the TROMPA project. From the requirements and first user-centered design studies as developed throughout the first year, year 2 of the project has focused on transforming these into concrete pilots that connect technical advances within the project and specific needs of end users in the different use cases.

For **WP7** there has been a further programme of Dissemination activities in the second year of TROMPA, involving all project partners, though public events from February 2020 have been seriously affected by the COVID-19 crisis.

The management tasks under **WP8** during the second period of the project have been carried out according to the plan. The procedures established at the beginning of the project have been followed. Organization and coordination of the actions amongst the consortium has been done effectively, within the agreed time and budget.

Regarding PM efforts, the PMs consumed represent the 69% of the total person-months (392,60 PMs). More efforts have been dedicated to WP3, WP5 and WP6, due to the technical developments related to technologies for music description and creation of the data infrastructure, and the preparation of end user pilots, that will also require significant efforts in the third year of the project.

Version Log		
#	Date	Description
v0.1	27 May 2020	Initial version submitted for internal review
v0.2	30 May 2020	Revised version after internal review
v0.3	3 June 2020	Minor fixes
v1.0	5 June 2000	Final version submitted to EU

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1. Introduction

As part of the project coordination activity, we regularly carry out follow-up actions through interim reports that ensure to monitor de implementation of the project in line with the established plan, identify possible deviations and implement corrective actions. These internal reports on the progress of the project are very important, and all the partners have an active participation, especially the Work Package Leaders.

This deliverable aims to reflect the work status and main scientific achievements of the project during the second year, through a progress report from month 13 to month 24 that includes the work carried per work package, dissemination and exploitation activities and use of resources in terms of person month consumed.

The objective of the deliverable is to provide an update of the project, highlighting the achievements and deviations that we have encountered during this second year of the project.

The structure of the deliverable is as follows: section 2 describes the work carried per work package. This information is structured in the same manner as the periodic reports. We provide a table for each work package where the work carried for each task and the corresponding deliverables are reported. Moreover we report and explain deviations from the original work plan. Section 3 is dedicated to the use of resources; person month distribution per partner/ work package and comparison to the total budget. Section 4 concludes this document.

2. Explanation of the work carried per work package

WP	1	WP Title	Ethics requirements
Summary of progress		Since industrial partners do not have ethical committees, all experiments involving human subjects will be conducted under the supervision of the academic partners (UPF, MDW, TUD, GOLD). In the current state of the project three out of the four partners that will be involved in experiments involving humans have acquired ethics approval.	
Detailed achievements		In the first year of the project we submitted Deliverables 1.1, 1.2 and 1.3 (M3) that describe the ethical issues taken into account. Regarding the ethics approvals only MDW has received it during the 1st year. For the 2nd year UPF has received ethics approval for the planned user interactions in May 2019 while TUD has a different ethics approval procedure: applications and approvals are to be made per experiment, and cannot be made in advance for a complete project. Regarding ongoing experiments (e.g. crowdsourcing microtasks), an application has been sent and granted. GOLD is on the process of iterating their ethics application with their local committee.	

Clearly significant results	Ethics approval from local committees for MDW, TUD and UPF.
Tasks Deviations (if applicable): impact and corrective actions	Since not all partners have acquired ethical approval for the full project, Deliverables D1.4 - H Requirement No. 4, D1.5 - POPD Requirement No.5 and D1.6 POPD Requirement No.6 have not been submitted. They will be submitted when all academic partners complete the ethics approval processes. The plan is to do the submission by M27.

WP	2	WP Title	Requirements and User-Centered Design
Summary of progress		WP2's main focus is on elicitation and prioritisation of the requirements for target user groups. Final requirements for user pilots have been developed and the corresponding technical requirements have been aligned with them. The process of requirements elicitation from user communities for sustainable exploitation opportunities beyond the project term has been initiated.	
Detailed achievements	T2.1	Submitted D2.2: We have collected the technical and non-technical requirements of the five pilots (targeting music scholars, orchestras, performers, choirs and music enthusiasts) that the consortium has converged upon after evaluating the initial user feedback and the technical challenges and opportunities for innovation. In order to make the origins of the requirements clear, for each pilot we have presented a user story that strives to capture the essence of and the benefits that the pilot provides to the users, while simultaneously touching on functionality that necessitates the requirements presented later.	
	T2.2	Requirements and user stories specified in D2.1 were used to develop mockups of applications for each of the five target user groups. The details of mockup testing and user feedback collected is summarized in the WP6 section of this document and described in detail in D6.1 Final Mockup Testing.	
	T2.3	Technical integration requirements have been analyzed and the approach to data management and application deployment has been agreed upon. A novel approach to user data management has been evaluated and already implemented by the Instrumentalists pilot application. User pilots and the shared Contributor Environment are being integrated by the use case leaders and VD.	

Clearly significant results	User groups and requirements were evaluated and summarized. The D2.2 Complete Requirements specification has been completed and submitted. The detailed user pilot plans have been presented in D6.2.
Tasks Deviations (if applicable): impact and corrective actions	There are no deviations in the tasks of WP2.

WP	3	WP Title	Automated Music data Processing and Linking
Summary of progress		In the second year of TROMPA WP3 continued focusing on developing technologies related to music description. We investigated the current state-of-the-art technologies for music description and processing that are relevant in the scope of classical music and in the context of the different TROMPA pilots, further developed them, as well as incorporated new . In addition, we defined the target repertoire and the corresponding repositories that are to be exploited in the TROMPA use cases.	
Detailed achievements	T3.1	The focus of this Task for the 2nd year was to coordinate the loading of the repertoire to the Contributor Environment with conjunction to Task 5.1 - Data Infrastructure and the pilot task leaders. Apart from that it was submitted the 2nd version of the Deliverable D3.1 - Data Resource Preparation(M18). This deliverable is a refinement of the 1st version of the deliverable submitted in M10 and describes in detail all the target repertoire and the related repositories that are used in the TROMPA. The 2nd version did not change a lot, and as the 1st version it it describes in detail a) the current public-domain repositories and their potential use in the TROMPA, b) which is the target repertoire for each use case, c) what are the technical requirements of the use case in terms of repertoire, d) what will be the contribution of each use case in the public domain, e) it provides a informative summary per use case including target repertoire, related repositories and data formats, and f) discussing how this data will be imported to the Contributor Environment.	

	T3.2	Submitted Deliverable D3.2 - Music Description (M24). This deliverable summarizes all the technologies that are developed for Task 3.2. In the second year of the project research we continued our research in the directions we did during the first year; we further develop the rhythm analysis methods using Deep Learning approaches by experimenting with new architectures, by using more data for model training as well as we expanded our methods to work with MIDI input. We worked on research of the impact of interacting with music recommendation from both system- and user-centered perspectives and on the influence of personal characteristics on emotion labeling and classification using language-sensitive Music Emotion Recognition models. Regarding singing analysis we worked on the development of a framework for the expressive analysis of choral singing recordings. Finally we implemented end-to-end encoder-decoder source separation algorithms for multi-instrument music source separation
	T3.3	Submitted Deliverable D3.3-2 - Audio Processing (M24). This deliverable summarizes the work we carried out to provide choir singing synthesis with multi-lingual support. We created new datasets for which we performed new recordings of the members of “Cor Francesc Valls”, a professional Choir from Barcelona. With these, we created four new voice models (Soprano, Alto, Tenor and Bass) that allow us to cover most of the choral music repertoire. These models are multilingual, i.e. the synthesis generates the same timbre for any of the supported languages: English, German, Spanish, Catalan and Latin. Regarding the synthesis of the whole choir, we opted for a voice cloning approach using speaker-adaptation. The newly generated TROMPA dataset is suitable for this, since we recorded 12 singers (3 per section). In addition, we improved the pitch contour modelling by integrating the Hybrid Neural-Parametric f0 modelling method, based on recent research at TROMPA partner UPF. For these tasks, we have updated internal tools to support, for example, collaborative data annotation using git repositories. We deployed all the new voice models to the VoSyn engine synthesis and cloud service, and performed tests on a large-scale dataset of scores retrieved from the Choral Public Domain Library. Synthetic performances of these scores will shortly be available in the Choir Singers Pilot, which currently already has synthetic pieces in 4 different languages using the new voice models. Additionally, we have worked on source separation for the case of SATB choirs, separating the different parts and individual voices for remixing and emphasis given to different parts and voices. We have adapted some state-of-the-art source separation algorithms for this task and have also proposed new novel techniques for our case.
	T3.4	While the main focus over year 2 has been to establish the necessary hybrid annotation setups for OMR error-correction (see WP4), beyond the full transcription and identify-fix-verify tasks, more tasks are currently under

		research that are more vision driven. These e.g. include clustering methods based on heuristically improved measure and bar detection outcomes. In addition, PN is investigating deep vision approaches for OMR. The intention is that these vision-based approaches will yield noisy outcomes, but will allow for a more user-friendly pre-population of information that can then be further improved in the crowd setting.
	T3.5	Development of T3.5 (alignment of multimodal musical resources) in year 2 has focussed on the implementation of two complementary alignment workflows, comprising real-time and an offline MIDI-to-MEI alignment. Real-time alignment is achieved using the Matcher for Alignment of Performance and Score (MAPS), a tool under ongoing development by mdw and external partners; while offline alignment is achieved using the state-of-the-art Symbolic Music Alignment Tool (SMAT; Nakamura, Ono, Saito, & Sagayama, 2014). The workflows implemented around this tooling incorporate new custom-developed processes to handle scores encoded in the schema of the Music Encoding Initiative (MEI), including pre-processing steps converting MEI encodings to MIDI representations, and post-processing steps reconciling the aligned MIDI output with MEI identifiers. The post-processed outputs are then converted into Linked Data (RDF) graph representations adhering to TROMPA's specialised alignment data model detailed in D3.5, an implementation of the Music Alignment and Linked Data (MELD) framework. This representation builds on the Segment Ontology, a convenient means of bridging music-generic structural representation with music-domain-specific multimodal resources; and through the custom TROMPA tooling developed to support alignments to MEI scores, the time-aligned segments are directly anchored into a musically meaningful score representation. MEI is a particularly suitable encoding schema for musical scores within TROMPA, due to its inherent comprehensive and hierarchical addressability which enables flexible alignment with the multi-level structural representation ("segment lines") offered by the Segment Ontology. These capabilities allow alignments generated in D3.5 to be performed at different layers of abstraction, from sections, phrases, or measures, down to individual notes, depending on the requirements of the individual use cases.
	T3.6	After establishing links to various online repositories and databases that were already made available on the Muziekweb website, CDR further investigated the possibilities of cross-linking. In consultation with TU Delft we have decided to focus more on Wikidata for T3.6. The validation process on the Mix'n'Match platform especially will be an important part.. At this moment, validation must be done by hand by volunteers of the Wikidata-community. Our goal will be to have more entries automatically validated. We will investigate the possibility

		of using the links to Musicbrainz as a part of making this validation process more convenient.
Clearly significant results		Deliverables D3.1-2, D3.2-2, D3.3-3, D3.5-3
Tasks Deviations (if applicable): impact and corrective actions		Due to the variations and iterations on the TROMPA pilots and prototypes, and the required WP3 technologies, we have extended Tasks T3.2 to accommodate the required data repositories and technologies to the final requirements of the prototype. Thus this extension had a positive effect on the implementation of the work plan and did not have any effect on the budget.

WP	4	WP Title	Crowd Annotation and Incentivisation
Summary of progress		WP4 focuses on involving the crowd (at varying expertise levels) for the description of multimodal music information and its use in the improvement of automatic algorithms. The ultimate goal of WP4 is to enable creation of (objective and subjective) knowledge about music material, so to achieve Objective [O2] of the project. During the first year of TROMPA, WP4 achieved its planned results, which included: 1) the development of models for the representation of relevant properties of crowd contributors (D4.2); 2) the design of incentivisation mechanisms for crowd contributors (D4.3); 3) the design and development of hybrid workflows combining the crowd with the automatic processes of WP3 (D4.4); and 4) the design of the building blocks of a framework for the continuous evaluation and improvement of technologies in WP3. In the second year of the project, further extensions were performed, including the establishment of more formalized crowd evaluation methodologies in hybrid algorithmic-user annotation setups (D4.1), a revision of the Annotator properties and metrics, now tailored towards Hybrid OMR pipelines (D4.2-2), a revision of the Crowd Incentivisation Mechanisms, now tailored towards expected user interactions (D4.3-3), and a presentation of Hybrid Annotation Workflows (D4.4).	
Detailed achieve ments	T4.1	Task 4.1 is devoted to the design and implementation of a hybrid crowd-machine framework for the continuous evaluation and improvement of the automatic technologies in WP3, as well as their combination with the crowd for data enrichment. During the first year of the project, work in T4.1 addressed the need for a common formal framework specifying data and control flows required to instrument the crowd in the most beneficial way.	

		The results of such efforts were partially reported in deliverables D4.2 – "Annotator properties and metrics", and D4.4 – "Hybrid Annotation Workflows". In the second year of the project, the focus shifted to the development of the methods and tools for crowd-powered improvements and enrichment, with special emphasis on classification methods as developed in WP3. A formal framework for this has been reported in public deliverable D4.1 - "Crowd evaluation methodologies", which also demonstrates how this can be applied to the context of Music Emotion Recognition, in which user feedback will be able to assist on algorithmic improvements. The deliverable also reports on several experiments that show how this framework is able to efficiently and reliably evaluate technology when ground truth data is scarce, and to improve the performance of final emotion enrichment compared to automatic systems alone.
	T4.2	Submitted deliverable D4.2 "Annotator properties and metrics v2". The deliverable presents the second version of the TROMPA Annotator and Annotation model, which defines at a conceptual level the knowledge that is relevant and necessary to enable the activities of the TROMPA Contributor Environment. More specifically, it investigates how the conceptual models of the first version can be applied on users who will contribute on a hybrid OMR pipeline, which is the main crowd-powered direction chosen in TROMPA: that of converting scanned score information into symbolic MEI information as part of hybrid OMR pipelines. Also, we studied the user-generated data on YouTube, to analyse the characteristics of the platform in regards to classical music information generation. With this version of the deliverable, we concluded the development of conceptual models for users, and in their current form, they will incrementally be implemented on the prototypes to come.
	T4.3	Following use case needs, the second version of D4.3, submitted in M18, revised the incentivisation models to also include a dynamic user behavior oriented layer. Considering expected features and facets of interest for the use cases, several concrete actions towards incentivising and motivating users are proposed. These are currently being integrated into the use cases. In this deliverable, the first version of the TROMPA model for incentivisation of crowds is complemented with the definition of the incentive recommendation model and the engagement model. More specifically, the deliverable investigates how the conceptual models for incentivisation can be instantiated according to the user profile, community goals, participation type, etc. Likewise, the deliverable introduces the engagement model, which provides a conceptual description of the different engagement phases and how use case leaders can suggest incentivisation mechanisms for each phase: enroll phase, grow phase and retain phase. Based on the incentive recommendation model, suggestions have been made for the use cases where workshops and testing

		sessions with real users have been performed and users' perceptions regarding their motivations have been collected, namely Music Enthusiasts and Choir Singers. These recommendations focused on the *grow phase* actions (how to facilitate users participation and contributions? how to give valuable feedback to users to engage them to improve their participation?) and on *enrollment phase* actions (what information must be provided to posible users to increase their interest in the use cases?). For Orchestras' use case, we followed a different approach, since similar recommendations have been made based on the desired users' profile, and recommended incentives will be tested in future workshops with real users.
	T4.4	Submitted second version of deliverable D4.4 "Hybrid Annotation Workflows". The deliverable describes the second iteration of the Hybrid Annotation Workflows models and technology developed in the TROMPA Project. The deliverable makes use of the two models, described in the previous version, namely: 1) a high-level model designed to represent the overall composition of a workflow relying on design patterns; and 2) a formal model for describing individual crowdsourcing tasks in a more fine grained fashion. To that end, we developed a prototype of a crowd-assisted OMR pipeline, "Crowd Task Manager", which is fully integrated with the Contributor Environment, as developed for T5.1, and the Campaign Manager, as developed for T6.3. More specifically, our prototype can retrieve new PDF files of music scores from the Contributor Environment, preprocess and segment the score, and create crowdsourcing tasks for transcription and verification, which are distributed to the Campaign Manager. The output of those crowdsourcing tasks, are then aggregated in Crowd Task Manager and the input music score is rebuilt into its MEI form. Each version of that MEI score is to be stored in a GitHub repository, to make them openly and easily accessible to people. This prototype is the first version of such crowdsourcing OMR pipeline and it will be further upgraded, using more aspects of conceptual models described in T4.2 and T4.4 document deliverables.
Clearly significant results		Deliverables 4.1, 4.2-2, 4.3-2, 4.4-2
Tasks Deviations (if applicable): impact and corrective actions		Extension of Task T4.1 in conjunction with Task T3.2 due to variations and iterations on the TROMPA pilots and prototypes.

WP	5	WP Title	TROMPA contributor environment
Summary of progress		This work package oversees the common part of the TROMPA data infrastructure. It consists of the Contributor Environment (CE) and a set of software components. The CE is a shared system with a web-API that exposes TROMPA content and functionalities, allowing all partners to store or reference data. The components provide developers with an easy and structured way to integrate TROMPA data or functionalities into a user-facing product. Both the shared CE infrastructure and the individual components have evolved significantly during this period. New functionality has been added across all parts. The components have been refined based on the more specific needs of the user pilot applications of WP6 that will integrate these components. The shared CE has been brought from the initial state to a more robust production environment. The CE-API has been updated multiple times during this period, with a major release before the M20 internar deadline incorporating all needed functionality for the WP6 user pilots and including the neo4j-graphql-js framework to simplify integration of the CE functionality in other components and applications. All components have been updated and released before the M20 deadline. Since then they have been integrated into the fully functional user-pilots of WP6. All code and reusable components have been made available via the public TROMPA GitHub repository[1]	
Detailed achievements	T5.1	The CE-API has seen two major updates after its initial release at the M12 milestone. In October 2019 a first round of feedback on the 0.3 version was incorporated which resulted in adding the following functionality: add JSON-LD support and fix several minor issues. In January 2020, several and more significant releases were done. In these releases a more elegant and simplified way to retrieve data from the CE was made possible by upgrading the neo4j-graphql-js library which also includes multiple fixes and features from the Videodock team. A Python-based CE-API client has been delivered[2] to facilitate reading from and writing to the Trompa CE.	

[1] https://github.com/trompamusic
[2] https://github.com/trompamusic/trompa-ce-client

		For the cloud-hosted production version of the CE-API, a basic authentication protocol has been added for security reasons..
	T5.2	The digital score edition component simplifies the incorporation of interactive digital score engravings within TROMPA applications. The component permits scores to be rendered from music encodings (e.g., MEI files); musical elements to be selected; and score annotations to be authored, imported, and visualised. An initial technical demo version was released in September 2019. Since then a more robust version has been released at the M20 milestone. It consists of a series of React components: MELD / Verovio score wrapper component permits rendering of music encodings as digital score; Verovio (score layout) options can be specified by TROMPA application[3] ; Score selections can be made using click-and-drag, with selection granularity (e.g., notes, measures) specified by TROMPA application; Web annotations can be authored for a given selection; only very simple annotation types for this first release (e.g., “highlight”, “describe”, “link”); Web annotations can be imported into a view of the score (specifying annotation URI or annotation collection URI); Web annotations can be visualised upon the score; only very simple visualisations for this first release.
	T5.3	In the project proposal, Task 5.3 responsibilities are described as Multimodal Integration and as Processing Library (D5.3). Together, these responsibilities comprise common access to (combinations of) public music data contained in the Contributor Environment (CE) database regardless of content-type and common access to WP3 algorithm processes to be run against (combinations of) this public music data. 5.3.1 A prototype version of the Multimodal Component was released at M12. Since then, a working version has been released at the M20 milestone. The initial version has been re-released as a series of React components, while adding multiple new features based on needs from the WP6 implementations: language select, removable search tags, new filter menu, responsiveness for mobile, search results total, better ways to filter data from the CE and the fixing of several minor issues in the codebase. Code to be found here[4]: 5.3.2 The TROMPA Processing Library (TPL) responsibility is to offer a communication layer between Use Cases, CEapi and WP3 technologies. It aims to encapsulate all music processing components of WP3 in a unified library and

[3] https://www.verovio.org/javascript.xhtml

[4] https://github.com/trompamusic/trompa-multimodal-component

		to facilitate a procedure for the automated processing of data with these components. Basic functionality was delivered at the end of Nov 2019. Since then the needed functionality has been expanded and became an integral part of the CE-API in Jan 2020 The following functionality is now available[5].
	T5.4	The music performance assessment component determines and publishes measures of score difficulty and performance quality, primarily targeting the instrumental players and choral singers use cases. The Music Performance Assessment Mechanisms v1 was delivered in M12. Based on general feedback and more specific needs of the WP6 use-cases the component has evolved. A more robust and functional version was released in February 2020[6] (M20), enabling the component to: Detect summarise and publish skipped & erroneous notes, deviations in tempo & intonation and is able to visualise quality metrics over a collection of renditions: Determine, summarise, and publish performed extent of score for a given rendition; Aggregate high-granularity error rates across collections of renditions; Aggregate high-granularity performed extent rates across collections of renditions; Use the two aggregate measures above to determine empirical high-granularity difficulty measure; Aggregate high-granularity difficulty measures into a difficulty index for a given movement / piece The following visualisations are available as React components: Visualise performed extent of a score for a given rendition; Visualise error rate across a collection of renditions; Visualise performed extent rates across collections of renditions; Visualise high-granularity difficulty measure across collections of renditions
	T5.5	The annotation tools component provides an interface that allows users to make annotations of audio recordings, including descriptive commentary, numerical ratings, or other symbolic annotations. The schema for describing and storing annotations was developed in collaboration with other use-cases that require an annotation component (including music scholars and music enthusiasts). This collaboration ensures that all use-cases that contain an annotation or ranking component can use a

[5] https://github.com/trompamusic/trompa-ce-client
[6] https://github.com/trompamusic/ce-music-performance-assessment-mechanisms

		shared schema in the Contributor Environment. This schema was based on the existing web annotations standard, allowing annotations to be compatible with any application that implements this standard. The integration of the schema into the Contributor Environment has been completed. Deliverable 5.5 described the annotation schema requirements, and the design of the annotation tool to be developed for the second version of the deliverable in M34.
Clearly significant results		All software has been released as open-source in a public repository on GitHub. The CE-API is, in an updated production-ready version, available on cloud infrastructure. All underlying components have been delivered in tested and working condition and have been integrated in the WP6 user pilots applications according to this table: **Use Cases** Scholars / Orchestras / Instrumentalists / Choir singers / Enthusiasts **WP3 Technologies** Audio Descriptors: ☐ ☐ ☑ ☑ ☑ Symbolic Descriptors: ☐ ☐ ☑ ☐ ☐ Audio Synthesis: ☐ ☐ ☐ ☑ ☐ Alignment: ☐ ☐ ☑ ☐ ☐ OMR: ☐ ☑ ☑ ☐ ☐ Cross linking: ☐ ☐ ☐ ☐ ☐ **WP4 Components** MEI improvement crowdsourcing: ☐ ☑ ☑ ☐ ☐ **WP5 Components** Score Ediiton Component: ☑ ☑ ☑ ☑ ☐ Processing Library: ☐ ☐ ☑ ☐ ☑ Performance Assessment: ☐ ☐ ☑ ☑ ☐ Annotator tool: ☐ ☐ ☑ ☑ ☑ **Other functionalities** user login: ☐ ☐ ☑ ☑ ☑ browsing CE (multimodal component): ☐ ☐ ☑ ☑ ☑ personal folder: ☐ ☐ ☑ ☑ ☑
Tasks Deviations (if applicable): impact and corrective actions		Transfer 3PMs between partners GOLD and MDW, and the corresponding budget Since MDW has a better expertise than GOLD in the field of score editing and capacity to implement the work of this work package, the partners decided to redistribute the effort in WP5 to ensure the best quality of the tasks.

WP	6	WP Title	End user pilots
Summary of progress		Following the requirements specified under WP2, the research conducted under WP3-4 and the foreseen common infrastructure under WP5, the work	

		under WP6 focuses on concretizing and integrating insights and achievements from WP2-6 into user-facing pilots, targeting the five target audiences in the TROMPA project. From the requirements and first user-centered design studies as developed throughout the first year, year 2 of the project has focused on transforming these into concrete pilots that connect technical advances within the project and specific needs of end users in the different use cases. Following the results of mockup tests, as well as the feedback of the reviewers, year 2 was started with a planning (D6.2) towards the first prototype releases, to be delivered at the end of the project year. Subsequently, within each use case, work was conducted to develop and integrate the necessary functionalities and technological components, such that user tests on non-mockup prototypes can be conducted at the start of year 3. In parallel, outreach has been performed towards potential audiences that can engage with these prototypes for each of the use cases. The results of these endeavors were formally delivered at the end of year 2, in D6.4-1, D6.5-1, D6.6-1 and D6.7-1; details per use case are given below. During the last months of year 2, while the implementations of the prototypes were to be delivered, the COVID-19 crisis emerged. While this has majorly impacted earlier plans with regard to in-person audience outreach, dissemination opportunities (e.g. Mahler festival) and workshops, the technical delivery of the prototypes was already well on its way, and thus the planning for these was only slightly affected (with corresponding deliverables having been delayed by a few weeks beyond the scheduled delivery time). With the difficulty and uncertainty with regard to outreach and physical facilities continuing over Summer 2020, we will expect more visible deviation at the start of year 3, although we are working on facilitating remote workshops and events where possible, and expect to still deliver the work as foreseen within the first half of year 3, also still allowing for a second iteration on the prototypes as originally planned.
Detailed achievements	T6.1	Following the workshops for requirements elicitation and mockup testing, conducted in year 1, a more detailed planning towards concrete prototypes was made, including cross-consortium discussions on what research (WP3-4) and technical integration (WP5) components could be included in the short term (first prototype delivery) and longer-term (second prototype delivery), and what audiences would be the first outreach targets. The planning is presented in D6.2; within the more specialized deliverables D6.4-1, D6.5-1, D6.6-1 and D6.7-1, with the knowledge of what could be integrated and whom could be reached out to for the first prototypes, further details regarding integration and audience outreach are given.

	T6.2	No mockups were designed under this use case, as the use case leader indicated a stronger need for workflow support than for end-user applications. A workshop has been held with music scholars at the British Library, demonstrating example cases in which MIR technology supports scholarly workflows. Beyond WP6, the music scholars in the TROMPA consortium also were actively advising on the design of OMR-related crowdsourcing tasks in WP4. In the second year of the project, the scholarly interests and consequent requirements on annotation and semantic enrichment were intended to be further validated in the context of the 2020 Mahler festival in Amsterdam, both involving annotation campaigns with Mahler experts, as well as a demonstrator presentation during the Mahler festival. Given the COVID-19 crisis, the festival was canceled, and the main Mahler expert we were interacting with had also been struck with the virus. We are currently reworking the earlier plans into a virtual Mahler showcase demonstration, to now be held at the beginning of Fall 2020.
	T6.3	At the end of year 1, a usability workshop on digital score annotation had been held with RCO orchestra musicians. From this workshop, it appeared that the professional musicians may not become the earliest adopters of the technology in practice. Following the reviewers' remark to also look beyond the professional scene and towards younger generations, at the beginning of year 2, outreach was performed towards student orchestras. From conversations with several members of these orchestras, it emerged that the ability to play from affordable, playable scores was a most pressing need, which also would be the main motivator for content owners such as professional orchestras to ultimately invest in digital scores. Therefore, the attention was refocused towards building a campaign manager, that would allow for the initiation of score conversion procedures in a hybrid crowd-powered framework. This also would be a good way to connect the work under WP4 towards a hybrid OMR pipeline, which was not literally foreseen in the original DoA, but practically turns out to be an important catalyst towards practical impact in the future, as no large-scale MEI resources exist yet. The campaign manager has been delivered at the end of year 2, and will be tested in collaboration with an amateur orchestra, also in connection to the frameworks as developed under WP4, and in compliance with the WP5 infrastructure.
	T6.4	Workshops have been held with pianists at MDW to assess rehearsal companion mockups and potential functionality. The CLARA rehearsal companion was released on Clara Schumann's 200th birthday, and will perform the basis for future user studies with conservatoire students. It has since been extended with further core functionalities around visualisation of

		performative aspects of rehearsals, particularly tempo curves and dynamic information (MIDI velocities); details are outlined in D6.4. Since initial release the companion has also been made more fully compatible with the WP5 infrastructure - particularly by incorporating an interface to the D5.1 data infrastructure through a secondary layer of user data stored in decentralised Personal Online Datastores (PODs) as outlined by the W3C Solid project, which safeguard T6.4 users' ownership and control over their data. Publication of such data to the TROMPA Contributor Environment under a public license (on user request) remains as a key development priority for year 3. As the COVID-19 crisis prevented in-person interactions in the last months of year 2 of the project, plans for user evaluations have been modified to include a stronger emphasis on online interactions; these will run in the early months of the third year of the project.
	T6.5	We developed a version of the pilot that satisfies all functional requirements for singers. For this, we have developed the piano roll visualisation, we integrated selection of multiple pieces, we integrated synthetic voices generated with the new voice models developed in T3.3, and we integrated automatic analysis visualisation by integrating the Voiceful Cloud service. This version has been tested with a group of 20 participants with different musical expertise in a remote workshop (due to COVID-19 crisis). This evaluation has shown that participants were highly satisfied with the different aspects of the application (visualisation, synthetic voices quality, automatic analysis...). It also helped to retrieve feedback about bugs in the current versions and suggestions for improvement. Taking this, together with the previously defined requirements that are still to be developed, we created a development timeline for the last year based on 4 milestones: integrating the CE, finalizing the singers functionality, providing a full version with conductors functionality and piece recommendation, and a final version fixing any issues identified during testing.
	T6.6	At the end of year 1, with the music enthusiasts being a broad, hybrid group, several potential routes forward were investigated regarding the pilot. Ultimately, the consortium settled on focusing on a pilot about music and emotion, such that ongoing research under WP3 could be connected, while speaking and learning about connections between music and emotions was considered to allow for an accessible form of engagement with music, that would not necessarily need specialized musical knowledge of users. We have designed a functional version of the pilot that satisfies the basic requirements defined in previous deliverables. The pilot is available in english and spanish. The english version has been tested with 17 users in mobile and web devices in a remote workshop. This evaluation provided valuable

		information about participants' main motivations to contribute within the community and how to adapt the incentivisation mechanisms to specific audiences. We have defined three main milestones for the following months: a first validated version for online campaigns, which we expect to have by end of M26 Full Integration with the CE; Full integration with CE, which we expect to have by the end of M29; and the Full Version (including the refinements in the recommendation system and in the implemented incentives) by the end of M32. From M33 until M34, we expect to do final testings to produce a final version to be delivered.
Clearly significant results		Deliverable 6.2, 6.4-1, 6.5-1, 6.6-1, 6.7-1
Tasks Deviations (if applicable): impact and corrective actions		There are no deviations in the tasks of WP6. However, at the moment the use case pilots were delivered, the COVID-19 crisis happened in Europe, which did mean that many planned user workshops had to be postponed, and evaluation will as a consequence be delayed throughout 2020, also impacting the planning of Deliverable D6.3. Deliverables 6.4-1 until 6.7-1 reported on specific impacts per use case; this will be taken into account for D6.3.l

WP	7	WP Title	Dissemination and exploitation
Summary of progress		There has been a further programme of Dissemination activities in the second year of TROMPA, involving all project partners, though public events from February 2020 have been seriously affected by the COVID-19 crisis. This is reported in detail in D7.2-2 - Annual Dissemination Report.	
Detailed achieve ments	T7.1	Task 7.1: Dissemination to music scholars Completed or planned activities involving, or of direct or potential interest to, music scholars include appearances and paper presentations at the following conferences, workshops, etc: ACM/IEEE Joint Conference on Digital Libraries (JCDL), Urbana-Champaign, Illinois, USA; Musikalische Interpretation bei Herbert von Karajan (International Karajan Symposium), Kunstuniversität Graz, Austria; Digital Music Research Network One-day Workshop, London; Music Encoding Conference 2019 Vienna; Music Encoding Conference, MEC 2019; Medieval and Renaissance Music Conference, MedRen 2019; International Association of Music Libraries and Sound Archives, IAML Congress 2019; ACM Conference	

		on Recommender Systems (RecSys 2019). Copenhagen; 20th Conference of the International Society for Music Information Retrieval Conference (ISMIR 2019); Graph Technologies in the Humanities (February 2020)
	T7.2	Task 7.2: Dissemination to music professionals The first demonstrator of the TROMPA Companion for Long-term Analyses of Rehearsal Attempts (CLARA) was publicly released on September 13th, 2019, coinciding with Clara Schumann's 2nd centenary, alongside twitter activity and blog posts. This first release demonstrated core capabilities of the TROMPA instrumental performer prototype, using a purpose-generated musical encoding and three performance recordings of Clara Schumann's Romanze ohne Opuszahl, which were also released online under a public license. David M. Weigl, Carlos Cancino-Chacón, Martin Bonev, and Werner Goebl. (2019) Linking and Visualising Performance Data and Semantic Music Encodings in Real-Time. Late-breaking News and Demonstrations (LBD) session at the 20th International Society for Music Information Retrieval Conference. November 2019.
	T7.3	Task 7.3: Dissemination to non-professionals On October 5th and 6th 2019 UPF-TIDE organized a workshop in Maker Faire Barcelona, where a first version of the Music Enthusiasts (ME) prototype was presented as a tool to support research in emotion recognition in music. The workshop aimed to highlight the importance of massive involvement of persons in tasks such as collecting training data and evaluating the results of designed algorithms. See[7] (in Catalan) A second version of the ME prototype was presented during a workshop with highschool students in the context of the Barcelona Science Week on November 12th 2019. During the session, some features identified by science to objectively classify and identify emotions in music were presented, highlighting the importance of music enthusiasts involvement to improve current knowledge and technologies. See[8]: These workshops highlighted the importance of having a good user management system to provide valuable feedback to the users as well as to provide better recommendations in future versions. See[9]: In April 2020, UPF and Voctro Labs organized a workshop for validation of the Choir Singers Pilot. Participants were recruited from choirs in Catalonia and

[7] https://bit.ly/MakerFaireUPF
[8] https://bit.ly/ScienceWeekUPF
[9] https://trompamusic.eu/node/107

		Seville, and this was also a first contact for having these choirs using the application in future releases. UPF and Voctro Labs made a plan for doing onsite workshops for the Choir Singers Pilot in the area of Catalonia. Due to the COVID19 crisis, these workshops could not take place. However, we are running an evaluation workshop virtually in May 2020 with 19 choir singers, and plans are now being made to run workshops remotely as well as to improve the tool with features that specifically support choir singers in the current situation. Several partners in the consortium were making plans to organize a TROMPA Challenge in the 2020 Sónar+D Innovation Challenge[10]. However, this event has been canceled due to the COVID19 crisis. Currently, we are waiting for updates from Sónar Festival in order to explore possibilities for organizing an outreach activity within the festival if it takes place before the end of the project.
	T7.4	Task 7.4: Dissemination to the R&D community A number of scientific publications were submitted at international conferences and journals. For an up-to-date list of publications see project website[11].
	T7.5	Task 7.5: Dissemination to industry Cynthia Liem (TUD) was invited to speak at the general assembly of the Nederlandse Vereniging van Muziekbibliotheken, Muziekarchieven en Muziekdocumentatiecentra (Netherlands association of music libraries, music archives and music documentation centres) in April 2020. Due to the COVID-19 crisis, the meeting has been postponed to Fall 2020. Jordi Janer, from Voctro Labs, participated in winterLAB[12], a program of presentations, round tables and workshops organized by Laboral, an art and industrial creation center in Gijón (Spain). There, he gave a talk about Artificial Voices in the Musical Field, discussing issues about singing synthesis in the context of artistic production and other applications for the general public, including choir singing synthesis in the context of the TROMPA project. Voctro Labs also participated with an invited talk at the GAMELAB 2019[13] conference held in Barcelona in June 2019. This is a conference that targets videogame professionals, and the talk was about the use of expressive artificial voices in the creative industries, which included the work carried out

[10] https://sonarplusd.com/en/sonar-d-innovation-challenge-2020
[11] https://trompamusic.eu/research/results/publications
[12] www.laboralcentrodearte.org/en/education/winterlab?set_language=en
[13] https://www.gamelab.es/en/technologies-that-expand-the-reach-of-videogames/

		in the context of TROMPA and how it can benefit the production of video game soundtracks with artificial choir synthesis.
	T7.6	Task 7.6: Exploitation Initial exploitation plans established by industrial partners VD, VL and PN, as outlined in D7.1 and D7.3.
Clearly significant results		Deliverables 7.1, 7.2, 7.3
Tasks Deviations (if applicable): impact and corrective actions		An extension of D7.3 Annual Exploitation Plan is asked.

	8	WP Title	Project coordination
Summary of progress		The management tasks during the second period of the project have been carried out according to the plan. The procedures established at the beginning of the project have been followed. Organization and coordination of the actions amongst the consortium has been done effectively, within the agreed time and budget.	
Detailed achievements	T8.1	The work done regarding project management during the second year can be summarized as follows: 1. Use the procedures and templates established on the Project Handbook. 2. Maintain efficient communication between partners, and with the EC. 3. Organization of 3 project meetings for both coordinating the working team and conducting scientific discussions with contribution of the WP leaders. The project meetings organized during second year are: Consortium and review meeting (Barcelona), June 2019 Consortium meeting (Remote), December 2019 Consortium meeting (Amsterdam), January 2020 4. Management of the first periodic report (June 2019) in a standardized manner, accordingly to EC guidelines, coordinating the contribution to the partners for the technical report and supporting partners to complete correctly the financial report. Follow up of the work done by partners and resources used through an internal report (December 2019) to monitor possible deviations and minimize the impact of them to the project. 5. Agree with partners tasks and budget modifications to ensure the dedication of the most efficient resources to the project and communicate them to the project officer. 6. Follow-up of an internal peer-review process to ensure the quality of deliverables.	

	T8.2	Contact established with European Choral Association for the choir singer use case. Further contacts initiated with several external potential collaborators and partners, that will be capitalized on in conducting the year 3 use case pilots. Discussions initiated to broaden and deepen exploitation strategies for year 3 and beyond. Visibility through talks in relevant communities, e.g. including the Music Encoding community and the Karajan Music Tech Conference. Participation in Sonár+D had been planned, but the festival got postponed due to the COVID-19 crisis.
	T8.3	The main focus of this task was to ensure that the data used for the pilots (with conjunction with Task 3.1 and Task 5.1) follows the FAIR principles. Moreover the 2nd version of the Data Management Plan has been submitted (D8.4).
Clearly significant results		Deliverables , D8.4 Data Management Plan, D8.6 Progress report
Tasks Deviations (if applicable): impact and corrective actions		There are no deviations in the tasks of WP8.

3. Use of resources (person month)

	WP1		WP2		WP3		WP4		WP5		WP6		WP7		WP8		**TOTAL PER BENEFICIARY**	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	**Planned**	**Actual**
UPF	-	-	5,00	2,70	30,00	24,54	18,00	8,85	21,00	13,29	14,00	10,72	6,00	4,82	19,00	14,53	**113,00**	**79,45**
TUD	-	-	5,00	2,96	8,00	6,40	36,00	30,88	6,00	4,05	10,00	6,31	2,00	1,17	8,00	5,45	**75,00**	**57,22**
GOLD	-	-	2,00	0,50	9,00	2,77	4,00	1,52	5,00	2,43	6,00	2,56	5,00	1,26	2,00	0,5	**33,00**	**11,54**
MDW	-	-	2,00	1,40	9,00	5,80	4,00	1,70	11,60	6,00	6,00	3,30	3,00	1,10	1,00	0,2	**36,60**	**19,50**
VD	-	-	7,00	2,46	-	-	-	-	14,00	13,09	8,00	4,41	4,00	1,44	2,00	2,55	**35,00**	**23,95**
PN	-	-	10,00	12,00	2,00	5,50	4,00	3,00	6,00	0,50	8,00	9,00	3,00	5,00	1,00	1,5	**34,00**	**36,50**
VL	-	-	5,00	5,00	9,00	10,00	-		8,00	7,00	8,00	7,00	3,00	-	1,00	1	**34,00**	**30,00**
RCO	-	-	2,00	2,25	1,00	-	-	-	3,00	0,86	6,00	1,01	3,00	0,41	1,00	1,3	**16,00**	**5,83**
CDR	-	-	1,00	0,33	3,00	2,50	3,00	0,71	2,00	1,07	3,00	1,19	3,00	1,40	1,00	0,63	**16,00**	**7,83**
TOTAL	**-**	**-**	**39,00**	**29,60**	**71,00**	**57,51**	**69,00**	**46,66**	**76,60**	**48,29**	**69,00**	**45,50**	**32,00**	**16,60**	**36,00**	**27,66**	**392,60**	**271,82**

Table 3.1. PM distribution per partners/WP

Table 3.1 presents the PM consumed for the first two years of the project along with the planned. If we consider the total amount of PMs planned for the project we can see that the PMs consumed represent the 69% of the total person-months (392,60 PMs). During this second year, more efforts have been dedicated to WP3, WP5 and WP6, due to the technical developments related to technologies for music description and creation of the data infrastructure, and the preparation of end user pilots, that will also require significant efforts in the third year of the project. In the third year we expect to dedicate more person months also to WP7, dissemination. In general the effort distribution is in line with the initial plan.

4. Conclusion

In this deliverable we presented the progress of the project in its second year and highlight that TROMPA reaches its goals. **WP2 focused** on elicitation and prioritisation of the requirements for TROMPA user groups and final requirements for each pilot have been developed along with the corresponding technical requirements. **WP3's main** task was the research and development of robust algorithms for music data processing. **WP4 achieved** the development of models for the representation of relevant properties of crowd contributors, the design of incentivisation mechanisms for crowd contributors and the development of hybrid workflows combining the crowd with the automatic processes of WP3 and the design of the building blocks of a framework for the continuous evaluation and improvement of technologies in WP3. **Regarding WP5** the Contributor Environment infrastructure and the individual components have evolved significantly during the 2nd year, new functionalities have been added, and the components have been refined based on the more specific needs of the user pilot applications of WP6 that will integrate these components. An emphasis has been **given in WP6**, where following the results of mockup tests, as well as the feedback of the reviewers, year 2 was started with a planning (D6.2) towards the first prototype releases, to be delivered at the end of the 2nd year. Subsequently, within each use case, work was conducted to develop and integrate the necessary functionalities and technological components, such that user tests on non-mockup prototypes can be conducted at the start of year 3. In parallel, outreach has been performed towards potential audiences that can engage with these prototypes for each of the use cases. **WP7 worked** on expanding the visibility of the project on both industrial, academic and general audience levels with a number of publications, talks and events.

After we have defined and implemented the user pilots (WP2, WP6) along with the necessary infrastructure (WP5) and workflows (WP3, WP4), our goals for the final year of the project will be prioritised to expand the target audience to reach project expectations, develop the pilots to be fully integrated with WP5 components and CE, contribute to public domain archives with a large amount of metadata created through WP3, WP4 and WP6 and further disseminate the project outcomes