Enhancing and Re-Purposing TV Content for Trans-Vector Engagement (ReTV)
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ReTV

Enhancing and Re-Purposing TV Content for Trans-Vector Engagement

Deliverable 5.3 (M39)

Second Validation of Engagement Monitoring Prototype

Version 1.0

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

After several rounds of technical development and iterative consultations with professional stakeholders, ReTV has delivered two applications for media professionals. These applications, built on the ReTV's Trans-Vector Platform (TVP), provide workflows that tap into the potential of multimodal content analysis to optimise audiovisual media assets and generate more value from them for both content owners and their audiences.

This deliverable presents the final versions of the two professional user applications: **Content Wizard** for the semi-automated workflow of audiovisual content publication across social media channels, and **Topics Compass** for media listening and predictive analyses. Both applications were validated by professional users and the gathered results demonstrate the potential impact of the ReTV solutions in operational contexts and point to promising areas for future research.

Additionally, this deliverable presents **user-defined video summarisation profiles** that propose how TVP's video summarisation service could be used as a stand-alone service and tailored to create summaries fitting different types of broadcaster content. The quality of video summaries was assessed by content owners and media professionals, and the resulting feedback was used to define how the service could be used by media organisations based on their specific collections.

1. Introduction

The ReTV Trans-Vector Platform (TVP) was built with the purpose to boost the efforts of media professionals, specifically broadcasters and media archives, in their workflows for audiovisual content re-purposing and re-publication. TVP provides capabilities to monitor and analyse the constantly changing digital media landscape, use various digital data sources and user behaviour to gain insights into potential opportunities for content publication, and analyse and adapt video content for optimal engagement on social media platforms.

Using various combinations of these capabilities, ReTV developed two professional user applications:

- **Content Wizard** - a social media tool with a semi-automated workflow for content publication. The tool supports the user in every step of the way: (i) providing suggestions for events and topics that are likely to garner interest with their audiences, (ii) optimising media asset search for large-scale video collections, (ii) adapting video content for optimal engagement experience on social media channels, and (iv) optimising the text accompanying video content to ensure that it reaches its intended audiences and achieves maximal impact.
- **Topics Compass** - a data analytics visualisation dashboard that monitors media stories as they evolve in real-time and analyses future trends that will be of interest to audiences online. It targets media professionals who want to perform more extensive research and analysis to understand the context of new stories and compare data sources against different features.

Deliverable D5.2 *First Validation of Engagement Monitoring Prototype* presented the first prototypes of these applications and their evaluation with professional users. At that point in time (M20 - August 2019), both Content Wizard and Topics Compass were in the early stages of development. Hence, testers were asked to provide feedback on the already integrated components as well as express their requirements that would influence future development.

The goal of this deliverable is to present the final versions of the two user applications and their evaluation in real-life professional workflows. The applications use the latest versions of the TVP components presented in D4.3 *Trans-Vector Platform, Final and Optimized Version*. Building on the evaluation results presented in D5.2, WP5 followed an agile software development methodology to translate user requirements into functional features. The industry partners in the project (NISV and RBB) refined and iteratively tested the features which were integrated by the technical partners (CERTH, Genistat, MOD and WLT) in consecutive sprints.

Next to the two applications, this deliverable also discusses in more detail the potential of the video summarisation service. During the consultation with media professionals from larger organisations, it became apparent that while they find automatic video summarisation very useful, they have different requirements for creating video summaries for different types of broadcaster content (news programmes, talk shows, documentaries, etc.). The solution currently provided within the Content Wizard application does not offer such a more granular approach. Hence, we introduced **user-defined video summarisation profiles** that propose more specific parameters that should be used for different types of audiovisual content.

This deliverable is structured as follows:

- The overall methodological approach of T5.3 is presented in Chapter 2;
- Chapters 3 and 4 focus on the Content Wizard and the Topics Compass, respectively, presenting in detail all of their features, the methodology for longitudinal user testing, and the results from evaluations with professional stakeholders;
- Chapter 5 outlines the proposed user-defined video summarisation profiles for different types of broadcaster content and presents the results of their evaluation with media professionals;
- Chapter 6 provides a discussion of the evaluation results and points to areas for future research and development.

2 Methodology

During the first evaluation (as reported in D5.2), ReTV had presented the early version of the two user applications with the TVP components that were available at the time. This was a *formative evaluation* that provided input on how to improve the existing features, which new features and functionalities should be added, and how the remaining development work should be prioritised. The focus of this deliverable is a *summative evaluation* that aims to assess how well the applications perform given their intended purpose. More specifically, four evaluation criteria were identified:

1. **Applicability** in real-world scenarios and workflows - do the tools adequately address the needs of media professionals? Do they enable users to better perform their daily tasks?
2. **Quality** of the results - do the tools return useful and meaningful results? Are the results accurate?
3. **Impact** on audiovisual content reuse and publication - do the applications enable media professionals to more effectively (re)publish audiovisual content? Do the tools help to optimise content creation and publication workflows?
4. **Potential** for future work and research - what new research questions and opportunities for further work arise? Are there any questions related to the accessibility, usability and transparency of the implemented technologies that require further attention?

Originally, the intention was to involve a group of media professionals primarily from external organisations to test both applications using a longitudinal testing methodology where applications are used for a prolonged period of time in operational contexts. This strategy was proposed as it allows us to observe the usability and utility of the applications in an uncontrolled, real-world environment, thus enabling us to evaluate the applications against the four criteria described above.

However, we needed to adjust this strategy for several reasons. Most importantly, we recognised that due to COVID-19, many media professionals were dealing with increased workload and personal obligations, therefore it was not feasible to find a large group of participants who could dedicate their time for a prolonged period of time for user testing.

Also, during the first evaluation some specific considerations came to light that impacted evaluation:

- Content Wizard. We found that in order to gain useful feedback based on the use of Content Wizard in real-world scenarios, users had to work with their own media content and data sources configured specifically for them. Due to legal restrictions, it proved difficult to upload enough video material from external parties to Content Wizard just for testing purposes.
- Topics Compass. Users evaluated the full capabilities of the Topics Compass dashboard very positively, but it became evident that the application would serve a smaller group of advanced users who need advanced functionalities for data analysis. To adequately evaluate the application, users would need to receive extensive training before the testing. Given the time constraints of the project and the commitment required from users for such training and evaluation, the longitudinal testing was not deemed the most appropriate evaluation methodology at this stage.

Considering the above, WP5, determined a more fitting methodology. We decided to carry out the testing with a more focused group of participants, composed primarily of professionals from different departments within RBB, NISV and two external organisations who have a very close relationship to NISV. Working with such a focused group of professionals who were closely connected to the ReTV partners allowed us to keep constant communication with the participants, learn about specific scenarios in which they used the tools, provide assistance to the users when needed and motivate them to provide feedback in a timely manner. Below, we summarise how each user application has been evaluated.

Evaluating Content Wizard (see Section 3.3):

- A wide selection of professionals from different departments within NISV and RBB were recruited after a careful consideration in order to gather feedback on different workflows and user needs. Using the video content provided by NISV and RBB, partners were able to provide the same configuration of Content Wizard to users from different departments within their organisations;
- A more focused group of participants enabled RBB and NISV to closely monitor the performance of Content Wizard for any errors and update the configuration as requested by each individual user. The insights gathered from this process will enable us to scale the user onboarding and configuration process in the future.

Evaluating Topics Compass (see Section 4.3 for more detail):

- Personnel from RBB and NISV involved in the project continuously used the tool throughout to see its effectiveness in response to different scenarios and gathered feedback that would influence technical development;
- NISV and RBB demoed Topics Compass in public events and informal meetings with media professionals where feedback was gathered on the application of the tool in concrete scenarios;
- The key predictive capabilities of Topics Compass were still evaluated via the original longitudinal testing strategy since a simplified and streamlined version of Topics Compass was integrated into the Content Wizard application.

3 Content Wizard

The Content Wizard application brings together the majority of TVP services to provide a **seamless, semi-automated workflow for audiovisual content publication across social media platforms**. Its goal is to support and optimise the labour-intensive task of constantly monitoring audience interests, matching them with relevant video content and publishing this content across a growing set of social media channels. It primarily targets editorial and marketing teams at broadcasters and media archives, who can benefit from the following capacities of the TVP:

- **Listening** - monitor new stories across digital media channels to identify opportune moments to repurpose audiovisual content. Analyse the context and language used across different channels to tailor textual content for higher impact and visibility.
- **Prediction** - plan content publication in advance by analysing topics that are likely to draw audience attention in the near future.
- **Adaptation** - automatically transform existing audiovisual and textual content into assets adapted for optimal experience on different social media platforms.

The following sections first describe the scenario development since the initial evaluation with professional users and provide a detailed description of the final functionalities. We outline how the tool was used during the longitudinal testing and present the results of its evaluation.

3.1 Scenario Development and Implementation

In D5.2, we presented the early version of the Content Wizard. The TVP services are integrated into an existing social media publishing platform called Levuro Engage, available via the sister company of the consortium partner GEN. Given that the tool already has the basic workflow for content publication that was desired for Content Wizard, this saved us development time and enabled us to focus on the unique features delivered by ReTV. At the time, the first version of the Video Summarisation component was integrated into the Content Wizard, and the concept for the remaining proposed features (which were under development at the time) was presented. In addition to monitoring content performance, these features consisted of recommendations regarding:

- upcoming current events and historic commemorations that could be used as an opportunity to (re)publish content;
- video content matching the selected topic for publication;
- keywords to include in the social media posts; and the
- optimal content publication time and date.

All of the above described features of the Content Wizard workflow received positive feedback from professional users, therefore it was decided to proceed with their implementation. Table 1 below summarises additional user comments and describes the way they were addressed in the development of Content Wizard. This includes comments gathered during the formal evaluation presented in D5.2, as well as feedback gathered by NISV and RBB during the entire implementation process via informal consultations with colleagues or demonstrations at public events. Due to the time and resources available, we prioritised the implementation and testing of novel features provided by the TVP that require the unique expertise of partners in the consortium. Since ReTV partners are committed to further improve the application, the

remaining features were logged on the project's gitlab space and will be considered in the future development of Content Wizard after the end of the project.

User Comments	Implementation Approach
Users want to maintain control in every step of the workflow to ensure high quality results, especially for the editing of video summaries.	(i) Adapt the video summarisation interface to provide a way for users to control the outcomes of video summarisation. (ii) In all features of the workflow, enable users to either edit the provided recommendations or provide them with an extensive list of recommendations for them to choose from.
Users want to use the prediction capabilities of the Topics Compass application in the Content Wizard workflow.	Integrate the simplified version of the Topics Compass dashboard that focuses only on prediction capabilities.
Users want additional tools for sound editing and subtitles for video summaries.	A range of already widely available solutions could be added to the TVP architecture and integrated the Content Wizard workflow to support this. However, such integration at this point would require significant resources for technical implementation. Therefore it was decided not to implement this feature at this point.
Users want to have an easy way to manage their media content and see relevant metadata.	(i) A special workflow was implemented for a use case where content that is removed from Content Wizard once the rights for its publication online expire. (ii) Metadata categories relevant for content publication workflow were added to the interface.

Table 1: User comments on Content Wizard from the first evaluation process and ReTV approach for their implementation.

3.2 Agile Development

From the previous evaluation of the user applications, we learned about user needs and priorities concerning functionalities and interface design. These features were assessed in terms of their feasibility given the resources and time available in the project. This was necessary to ensure that at the end of the project ReTV would release a fully-functioning application ready for exploitation, while also presenting a roadmap for further front-end improvements.

Given this list of priorities and features, WP5 decided to structure this work in an agile way that would ensure collaboration between technical and industry partners in the consortium and enable a user-driven design approach where external stakeholders can be iteratively invited to provide feedback. For this reason, the *Shape Up* methodology was selected for the development of application functionalities.[1] In short, Shape Up structures software development in six-week sprints where new fully functioning features are released at the end

[1] https://basecamp.com/shapeup/webbook

of each sprint. It provides a way to set specific and realistic goals and foresee possible hindrances and risks.

Based on this methodology, WP5 used the following process. First, based on the prioritised list of requested features, industry partners prepared pitches that defined solutions to address problems in the current content creation, adaptation and publication workflows (see Appendix A for an example of a pitch). In discussion with technical partners, the pitches were clarified and their feasibility was assessed. This was followed by the development stage where the proposed solutions were implemented. For each sprint, two or three pitches were selected. During this period, all partners maintained regular communication to track progress and discuss any arising questions or issues. Towards the end of the sprint, use case partners could use the staging environment to test for any errors or improvements. At the end of each sprint, NISV and RBB showcased the implemented features to stakeholders interested in using the tools and gathered input on data quality and configuration requirements for specific use cases.

Fig. 1 below presents the final architecture of the Content Wizard application using the TVP services. As mentioned above, the Content Wizard is built on top of an existing social media publication platform Levuro Engage that provides many of the basic features needed for a professional tool. This includes integrations with the different social media APIs, user-management and security. The ReTV features are part of the core application, but only activated for the specific user groups that ReTV uses for testing. Levuro Engage serves as a frontend, while the business logic required for ReTV is handled by the API services which are part of the TVP.

For a detailed description of how the TVP APIs are integrated into the Content Wizard workflow, see Section 4.2 in D4.3 *Trans-Vector Platform, Final & Optimized Version*.

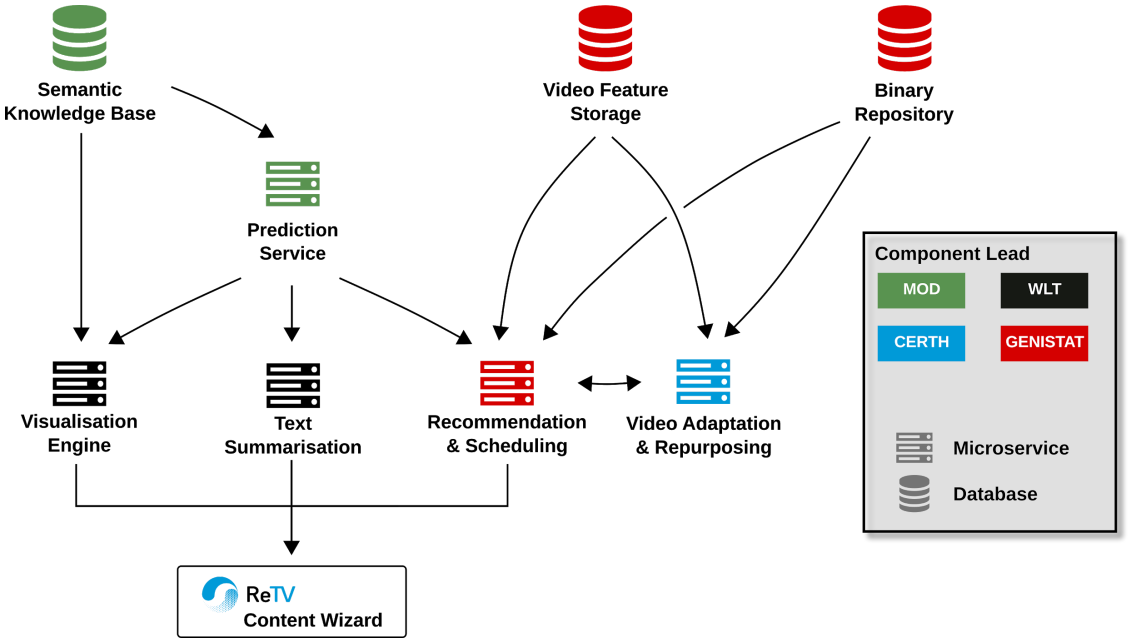


Figure 1: The TVP configuration of the Content Wizard.

3.3 Final Prototype

The paragraphs below present the final capabilities of the Content Wizard application at the end of the project. It describes a step-by-step workflow that a marketing team specialist, editor

or curator at a broadcasting organisation or a media archive would go through to publish video content across multiple social media platforms. Individual features of the tool could be used to support the creation of other types of online content, including blogs, news articles, etc.

Planning Calendar

The first step in the workflow is getting ideas on topics for content publications that would be relevant for the target audiences online and would attract their attention at a specific moment. For this, the user can open the Planning Calendar (see Fig. 2) which displays upcoming and historic events from the TVP's Semantic Knowledge Base through the Events and Anniversaries API. This includes the following categories defined by the use case partners (additional categories can be added as requested by the user):

- **Holidays** - public holidays, religious and national celebrations;
- **Culture** - international commemoration and awareness days (e.g. International Women's Day, World Poetry Day);
- **Sports** - upcoming sporting events;
- **Anniversaries** - births and deaths of famous people. Can be narrowed down according to the place of birth/death and/or profession;
- **Politics** - upcoming elections.

To ensure meaningful results that do not overwhelm the user with too many suggestions, a template can be created to define what events would be of interest to each user of the Content Wizard and their specific audience. For example, in the configuration for the consortium partner RBB, mainly events that are happening in Germany or related to German persons or German history are displayed. For the NISV setup, events encompassing the whole of Europe are of interest therefore the template was configured to filter events by location, where the location must be in a European country.

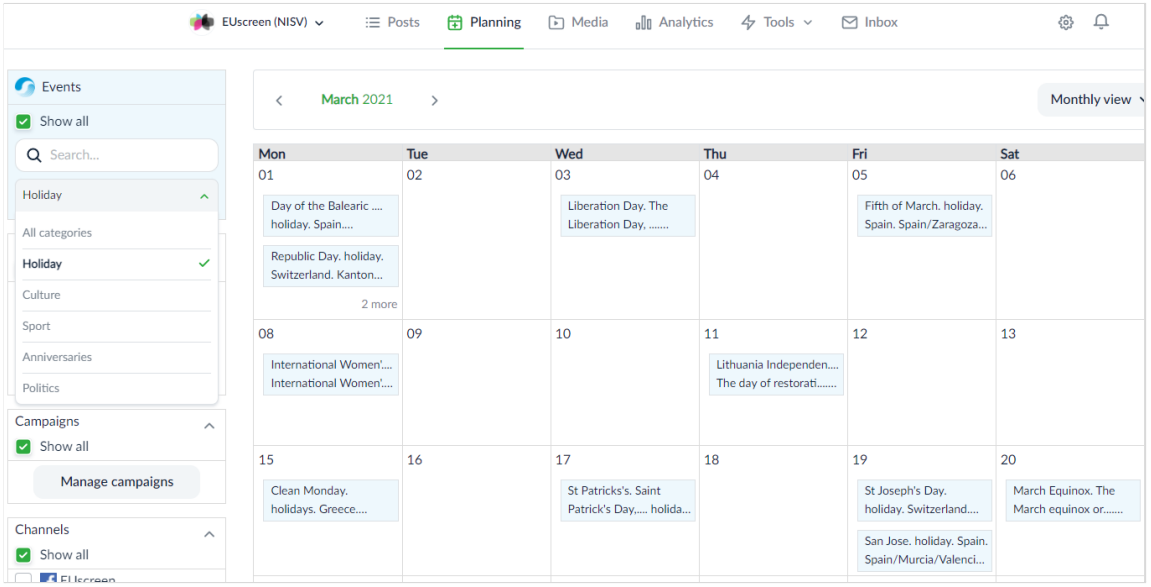


Figure 2: Content Wizard's Planning Calendar page with the event category "Holidays" selected.

The calendar provides users with an extensive overview of events that will be the topic of online discussions around those days and therefore they present an opportunity to create

content that will gain more attention and visibility. By hovering over the title of the event, the full title, date, location and a short description are displayed. By clicking on the event, the user activates the Video Search step to retrieve related media content (see below).

Trending Stories

Another way of finding opportunities to promote audiovisual content is the Trending Stories feature, a simplified version of the Topics Compass dashboard. It can be used to (i) identify a news story that provides an opportunity to repurpose content, or (ii) learn more about a topic chosen from the Planning Calendar by exploring related documents. The feature is configured to monitor and analyse documents that reference future dates (we refer to this configuration as the Prediction Mode) specifically to support content planning workflows.

Since users expressed that they need a simplified version of the Topics Compass dashboard, the Trending Stories feature offers five tabs that enable users to explore the data without potentially overwhelming them with the other advanced functionalities of the full Web dashboard, namely: Documents List, Tag Cloud, Storygraph, Keyword Graph, and Trend Chart. These were selected specifically as they allow the users to connect a news story to a particular date when it will be popular (Story Graph and Trend Chart), better understand its immediate context and further narrow down the search (Tag Cloud and Keyword Graph) and explore the original documents (Documents List). Similar to the full Topic Compass dashboard, users can define their search focus by entering a search query or using one of the predefined bookmarks, and use a Tooltip to narrow down their search results. See Section 4.2 for a detailed description of different visualisation and user interaction functionalities.

One additional feature added specifically to support the Content Wizard workflow is that the user can click on a particular keyword or story to activate the Video Search option and find related video content (see the next section). For example, a user might enter a query “anniversary” to look for any upcoming days for commemoration or celebration over the period of the next two weeks (see Fig. 3). Looking at the keyword graph visualisation, they can click on one of the keywords and narrow down the search results to see documents related to that particular story and also initiate video search based on the selected keyword.

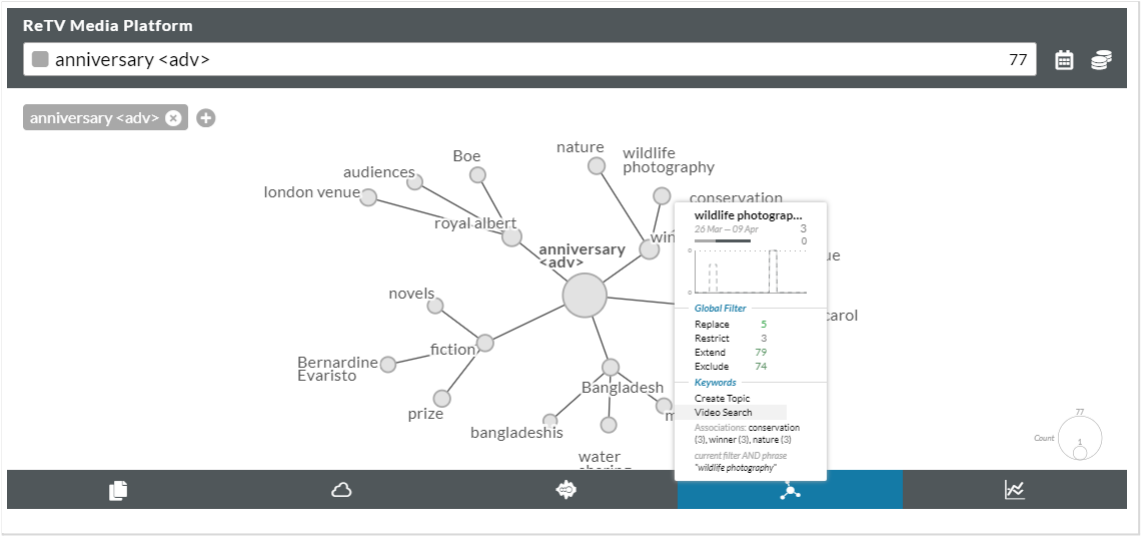


Figure 3: Trending Stories feature in Content Wizard (the embeddable “light” version of Topics Compass).

Video Search

Once the user has chosen a topic - either by using the Planning Calendar or Trending Stories - the next step is finding relevant content from the media collection to illustrate that topic. Normally, the user here would switch to their media asset management system. In most systems, this search is based on content titles and available metadata, which often do comprehensively describe time-based media content. This means that videos that do not have extensive descriptions are rarely retrieved. This is especially the case with historical content.

To ensure that media organisations reuse and republish potentially older and more diverse content and leverage the long-tail of their collections, video search was integrated into the Content Wizard. The search retrieves videos related to a given search query (in this case, a title of an event from the Planning Calendar or keyword(s) selected from the Trending Stories feature) based solely on the visual analysis of the videos. For example, Fig. 4 shows search results for the International Children's Book Day event selected from the Planning Calendar. Even if the video titles or descriptions do not contain exact words of the search query, they have been ranked high as they contain shots related to children's books or books in general.

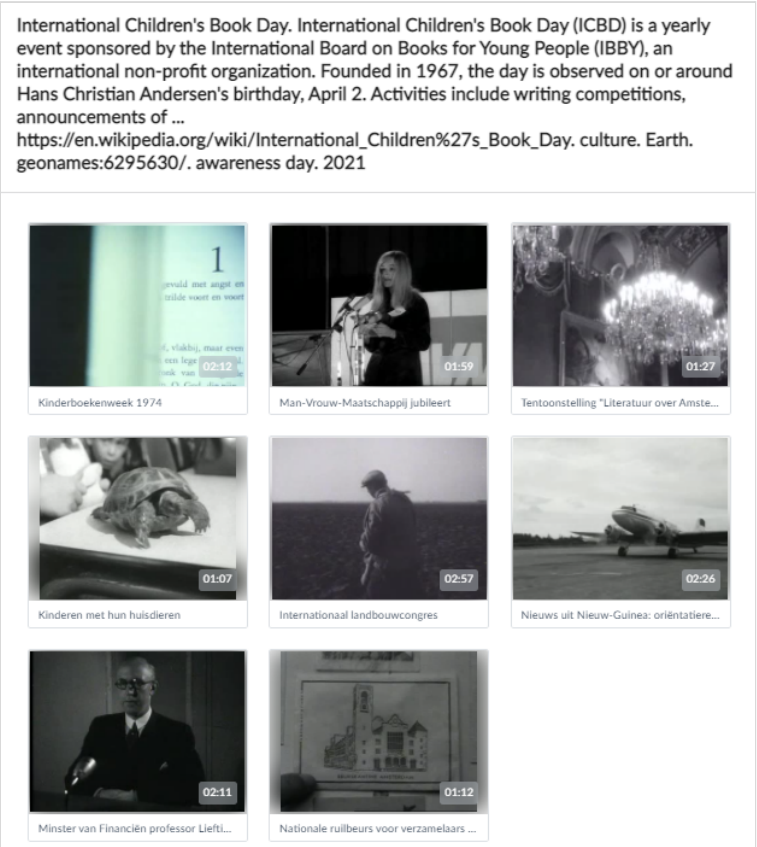


Figure 4: Video Search results for the International Children's Book Day selected from the Planning Calendar.

The interface has been configured to show between five to fifteen most relevant search results, providing users with enough videos to choose from, while not overwhelming them with too much choice.

Video Summarisation

Once a video is selected, the next step is preparing it for publication on social media channels. Given that audiences on social media are used to quickly scrolling through their news feeds and consuming short-form content, video editing is required to turn full-length videos into shorter clips suitable for publication on social media. Some social media platforms have a specific limit on the length and size of videos that can be uploaded therefore such video editing becomes a requirement rather than a choice.

The Video Summarisation feature in Content Wizard automatically shortens a selected video into a summary of a specific length optimising it for different social media platforms, while keeping the key parts of the full video. The interface of this feature (see Fig. 5) allows users to configure video summaries according to their needs:

- Users can choose from **Preset Profiles** which have been defined to generate summaries of optimal length for consumption on different social media platforms. This includes: Twitter, Facebook Stories, Facebook Feed, Instagram Stories, Instagram Feed, and TikTok (see D6.3 *Second Validation of Personalization Prototype* for more detail on these profiles);
- **Length** setting is recommended by the Preset Profile but can be manually adjusted if needed;
- **Range** allows the user to define the part of the video from which the summary should be created. For example, for a TV series, the last 15 minutes could be excluded from the summary to avoid any spoilers;
- **Cut Frequency** determines the speed at which the shots in the summary change, i.e. a high percentage means that shots are changing very fast, whereas a low percentage would create a summary composed of longer shorts.

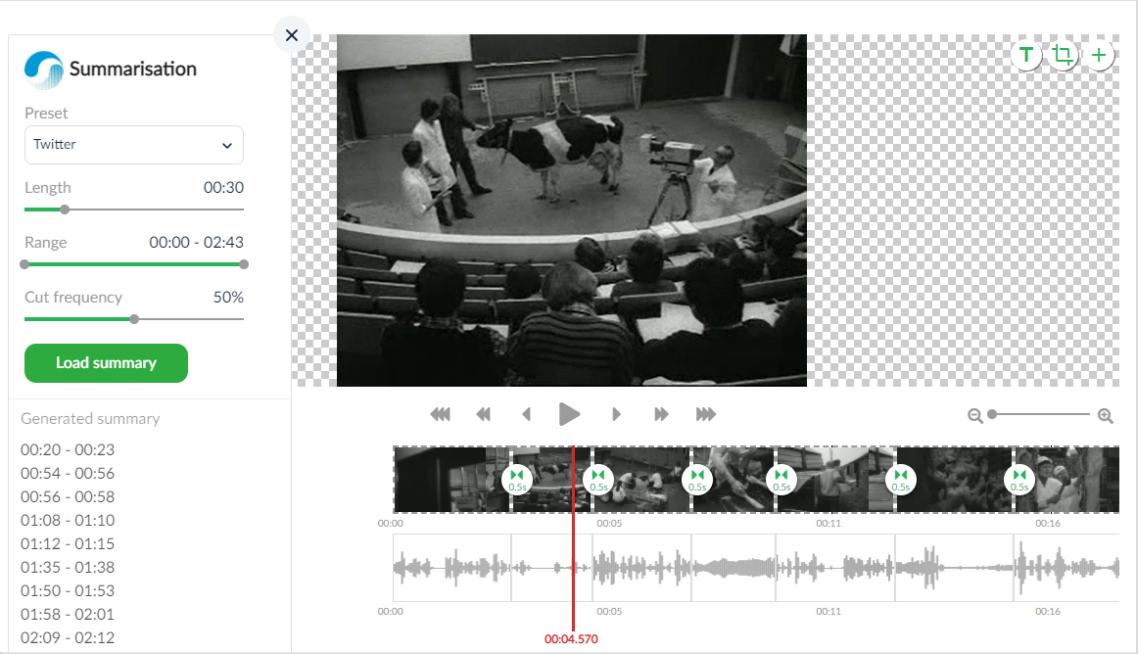


Figure 5: Content Wizard's video summarisation page.

When videos are uploaded to the Content Wizard, they are immediately analysed by the video analysis service, and the extracted features (temporal segmentation data, extracted concepts, detected objects) are stored for future use in a distributed storage (S3 provided by

exoscale.ch). When a summary is requested, summarisation is instantaneous as those features are pre-computed. The video editor displays the individual segments that the video summary is composed of. It was important to give users creative control over the final results therefore the user can edit these segments, change their order, delete them or add additional video clips (for example, a branded intro/outro). The application also provides standard video editing features, including adding overlays and cropping.[2] Users who want to use advanced video editing software, can download the summarised video for further editing.

Text Optimisation

Once the video content is ready, the next step is creating a compelling text to accompany it. The text editor (see Fig. 6) provides advanced functions to optimise the text based on real-time analysis of related texts published across digital sources. The user can either paste an already prepared text (e.g. a blog post that they want to promote by creating a social media posting) or use the editor to write the text from scratch. The text optimisation feature offers four main functionalities:

- **Generate Summary** automatically shortens the text to a desired number of sentences, facilitating its use on social media channels. The user can choose between three options: (i) Content focuses on key aspects of the story by selecting the most characteristic sentences; (ii) Sentiment uses sentences with a positive sentiment; (iii) Google Search favours sentences with popular search terms.
- **Suggest New Terms** provides a source of inspiration for possible keywords or hashtags to include in the text (the suggestions are based on co-occurrence analysis, comparing the text of the document with the reference corpus from news or social media; terms already present in the document are being filtered).
- **Explore Related Content** presents a list of documents related to the topic of the text (based on vector space similarity of the automatically extracted document keywords and the documents from the reference corpus);
- **Analyse Current Text** evaluates the current wording of the text and provides suggestions on how to improve it. It recommends keywords that would help to improve the ranking of the text on search engines, highlights repetitions and proposes possible synonyms based on the tone of the message;

Focus keywords are employed to tailor the results of the above listed functionalities to a specific topic. These focus keywords are automatically extracted from the original text (see the grey and orange cells the Fig. 6) and the user can remove terms they find irrelevant and manually add new ones, which allows them to easily configure and control the focus of the provided recommendations according to their needs.

[2] While smart cropping technology, developed by CERTH, is part of the capabilities of TVP, at this point in time it has not been implemented into the Content Wizard application. Given that the Levuro platform on which Content Wizard was built already had a manual cropping functionality optimised for different social media platforms, it was decided to leave this feature for future development and prioritise other features which were essential for the workflow. The smart cropping feature could be tested using the Video Summarisation web service: http://multimedia2.iti.gr/videosummarization/service/start.html. See D6.3 *Second Validation of Personalization Prototype* for more detail.

Figure 6: Text optimisation feature in Content Wizard.

The language of the application is determined in the API call and can be configured per user. Currently, German and English (US as well as UK)[3] versions have been integrated into Content Wizard. Providing additional languages is planned as part of the post-project exploitation.

Recommended Publication Date

The final step in the workflow concerns choosing the appropriate date to publish the social media post on the selected topic. If the topic is selected from the Planning Calendar or the Trending Stories feature, the user is likely to publish content on the day that the topic is associated with. In circumstances where the topic is not tied to a particular date, Content Wizard provides a recommended publication day (see Fig. 7).

The recommendation is based on the text created in the previous step for the social media post. The Prediction API provided by MOD predicts the future frequency of mention of the combination of keywords used in the post for the following 30 days. In the Content Wizard we select the publication date to coincide with the day of the highest predicted frequency. The publication time on that day is set manually by the user.

[3] Given the linguistic differences between American English and British English, they are available as two separate configurations.

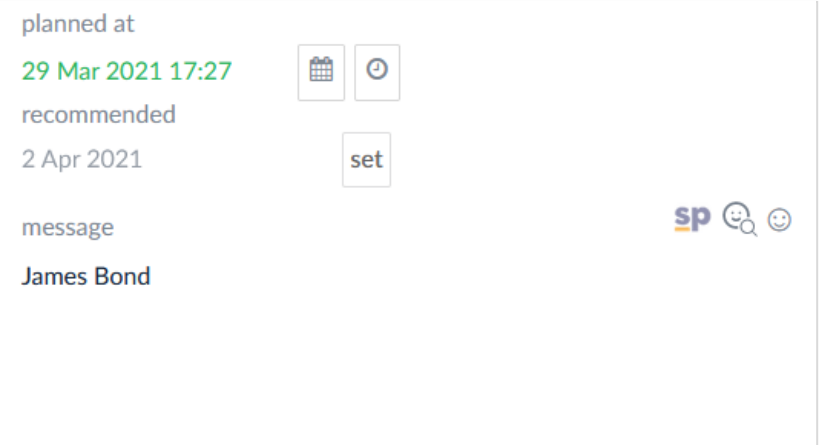


Figure 7: Recommended publication date feature in Content Wizard. Here, a user entered "James Bond" in the text field and 2 April is suggested as an optimal publication date. This date is recommended because the latest James Bond film was scheduled to open on 2 April.

3.3 Longitudinal User Testing

Methodology

The testing, led by NISV and RBB, was executed as planned for four weeks in February-March 2021. The testers were identified in advance to ensure that the tools could be configured with relevant data and media content for their needs.

To start the evaluation process, NISV and RBB hosted one-hour sessions with each group of testers to introduce them to the applications and explain the testing procedure. To ensure completeness and accuracy of the results without causing extra strain on the participants, they were asked to use the tool at least twice a week.

Both qualitative and quantitative data was collected via the following instruments (see Appendix B for all the below listed questionnaires):

- **Intake surveys** where participants were asked questions about their current workflows. This information could be used as a benchmark to understand their needs and contextualise the results of the surveys described below;
- **Weekly questionnaires** where participants were asked to provide details on how they used the tools each week were sent out three times;
- **Final surveys**, sent out at the end of the four-week testing, were designed to provide an in-depth evaluation of the applications and their usability. A combination of questions about the usability, data quality and potential use in the current workflows were used;
- Alongside this, participants were invited to provide **qualitative feedback** by directly contacting NISV and RBB throughout the whole testing. This happened in cases where participants had questions or requests for configuration changes, and revealed useful insights about the usability of the applications.

The surveys were fully anonymised: (i) users were asked to create pseudonyms and use them throughout the whole testing period allowing us to analyse and compare data from consecutively sent out surveys from the same participant, and (ii) no questions that could reveal a person's identity were asked. All surveys were conducted using the LamaPoll survey

tool.[4] One of the reasons why this particular tool was chosen was its strict compliance with the GDPR regulations, including the encryption of IP addresses.

Participants and Configuration

In total, six participants took part in the longitudinal users testing. This includes professionals from different departments within the industry partners NISV and RBB organisations as well as one external organisation. The participants were carefully selected, as they needed to understand and represent the overall workflows and requirements of their respective departments. They were also required to complete the tests and surveys during their daily work.

Before the evaluation process started, all participants were consulted to provide input on how Content Wizard should be configured to best match their needs and workflows. For example, a user who wants to increase the repurposing of news programmes from their archive and targets audiences in a particular region, would want to use data sources that are tailored to this region as well as follow broader, international topics that could be related to videos in their collection. Three configurations were created for the recruited participants. Each configuration could be used by multiple users, and separate accounts were set up on Content Wizard for each user group (e.g. one account was shared by multiple people from the same department). During the testing period, additional changes were made when requested by participants.

Table 2 below presents the components of Content Wizard that were configured for each user group and presents an example of how they could be tailored for the specific needs of future users.

Content Wizard Feature	User Group 1	User Group 2	User Group 3
Events in the Planning Calendar	- Historic events and holidays concerning Germany - Births and deaths of Germans in arts, media, science, culture; - International awareness days; - Contemporary sporting events.	- Historic events and holidays concerning European countries; - Births and deaths of persons in arts, media, science, culture; - International awareness days.	- Historic events and holidays concerning European countries; - Births and deaths of persons in arts, media, science, culture; - International awareness days; - Contemporary sporting events.
Bookmarks, data sources and language in Trending Stories feature	- Interface language in German; - Data sources: social media, news portal, miscellaneous, TV/radio, EPG in German only; - Bookmark monitoring	- Interface language in English; - Data sources: social media, news portal, miscellaneous across all languages (English, German, Dutch); - Bookmarks	- Interface language in English; - Data sources: social media, news portal, miscellaneous across all languages (English, German, Dutch); - Bookmarks

[4] https://www.lamapoll.de/

	only a selected amount of data sources by the RBB editorial department of Fritz.	monitoring the following topics: Cultural Events, Music History, Innovations & Scientific achievements.	monitoring the following topics: Women's History Month, Black History Month, LGBT History Month, Cultural Events.
Media collection	All available on-demand videos of RBB TV from the RBB online archive.[5] Using a JSON feed, each day the newly published videos (about 40) were automatically fetched and then transferred to the Content Wizard's repository. Videos that were older than seven days were automatically removed for legal reasons regarding online usage.	Open Images collection from the NISV archive.[6] In total, 2,124 videos all available under open licenses (namely Creative Commons or Public Domain) were uploaded to Content Wizard.	At this point, it was not possible to integrate the media collection for this user group therefore they tested Content Wizard without the video retrieval and summarisation features.
Language and data sources used in the text editor	Interface language in German.	- Interface language in English. - British English data sources are used for recommendations.	- Interface language in English. - British English data sources are used for recommendations.

Table 2: Content Wizard configuration for the longitudinal user testing.

3.4 Evaluation Results

Current Workflows

Most of the recruited participants create social media posts in their daily work (83%). 50% also create blogs and audiovisual content and a third writes news articles/essays. Another third produces other content such as Instagram Stories and articles for intranets, websites, apps (see Fig. 8). The full Content Wizard workflow or its individual features could be used to support the creation of all these types of content.

[5] Thematically, the videos were wide-ranging, including news, films and documentaries. The media pool thus formed an ideal basis for the various needs of the participating editorial departments to be able to create videos for the social networks tailored to their respective target groups. https://www.rbb-online.de/fernsehen/

[6] The majority of videos in this collection date back to 1920-1960s, and often there is little metadata associated with them, making it difficult for media professionals to curate and present these videos in a new light that would appeal to contemporary audiences on social media. Hence this collection would highly benefit from the capabilities offered by Content Wizard. https://openbeelden.nl/.en

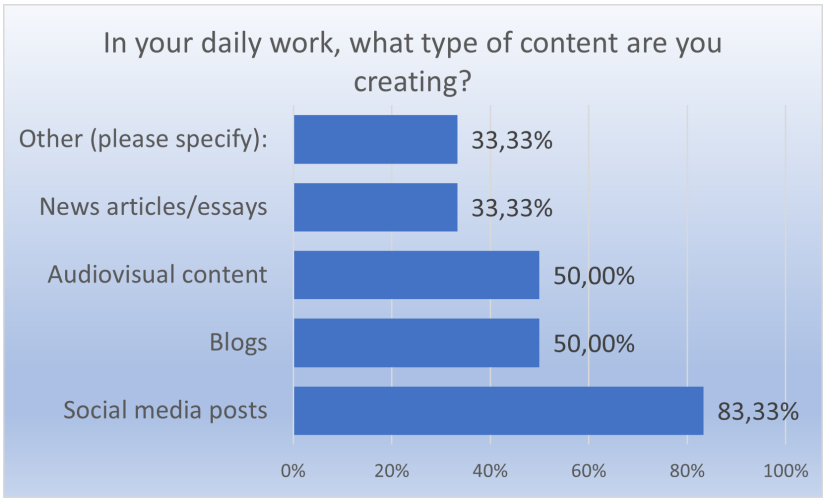


Figure 8: The different types of content created by the participants in their daily work.

More than 83% (the vast majority) of participants said they use online tools/services or software for finding topics for content publication. The use of services for publishing content across multiple social media channels is also a common practise (67%). In addition, in this multiple choice question, half of the participants reported using software for video/sound editing. Interestingly, only one third already uses tools for text analysis and optimisation therefore the Text Optimisation feature would propose a novel functionality in their workflows (see Fig. 9). Given the participants' experience with already existing solutions, we could observe how Content Wizard capabilities compare to them.

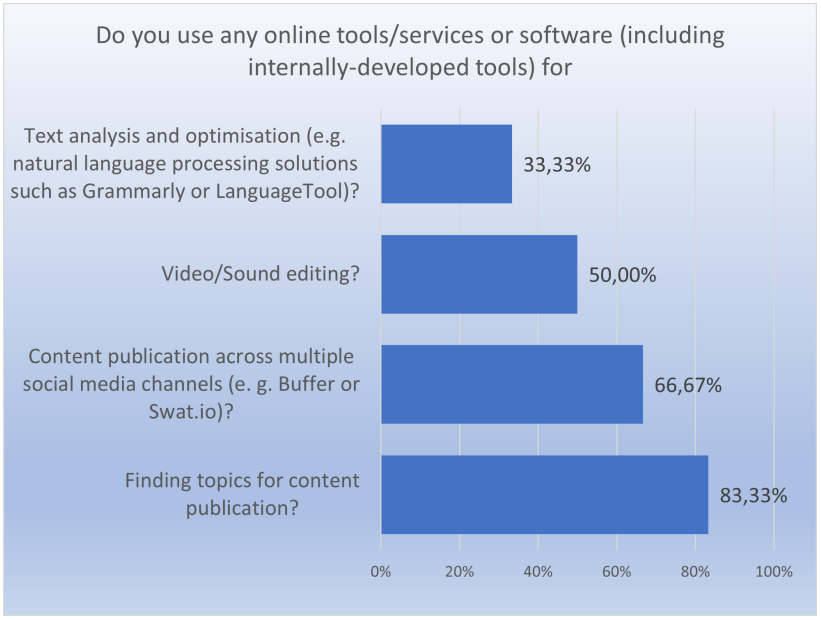


Figure 9: The use of already existing solutions by the participants.

In terms of the resources the participants use for their content publications, all participants stated that they use online calendars (see Fig. 10). News portals and social media channels are also used by the majority (about 83% each). A third makes use of other sources, e.g. internal event databases, press reviews, statistical evaluations, corporate agendas/actions, websites, suggestions/ideas, brainstormings and daily life observations. Given that the Planning Calendar

and Trending Stories can provide most of this data, we could observe whether Content Wizard enables users to choose topics more efficiently.

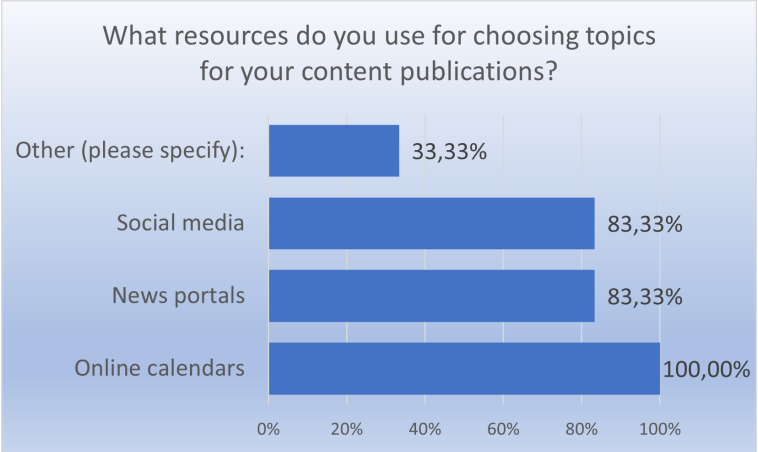


Figure 10: Resources currently used by the participants to choose topics for content publications.

For the four main functionalities covered by the Content Wizard, the most time is currently spent on finding topics for content publication. 50% of the participants invest between 6 and 10 hours per week on this task, the other 50% 1 to 5 hours. 1 to 5 hours are also needed by half of the participants to publish content across multiple social media channels. For video/sound editing, the weekly effort for two thirds of the participants is less than one hour (see Fig. 11). Since video editing is usually a time-consuming task, this implies that most of the participants currently delegate it to other members in their team specialising in this task.

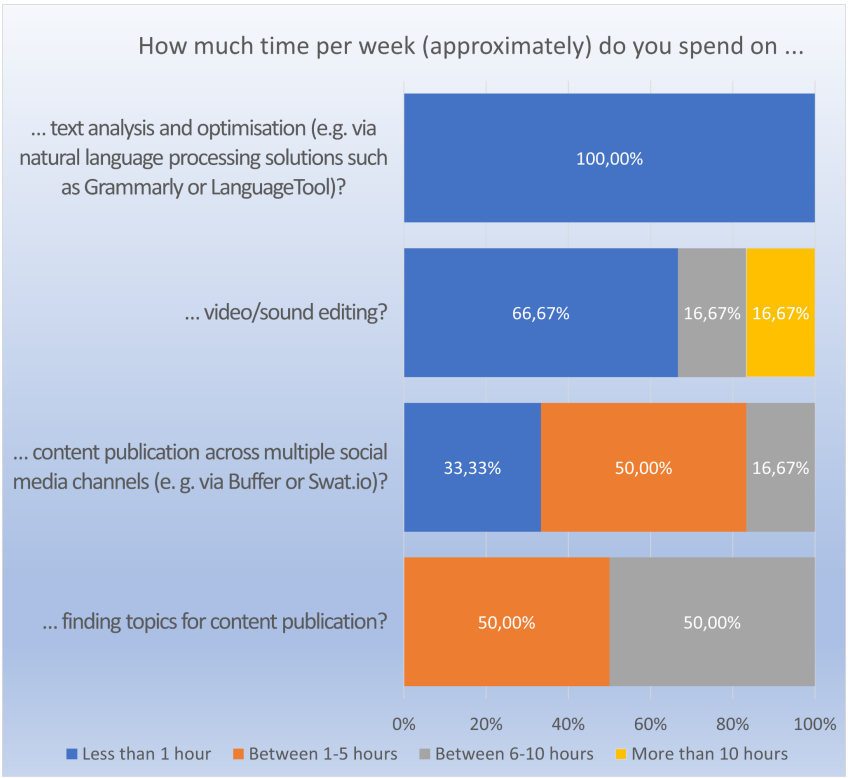


Figure 11: The time currently spent per week by the participants on different tasks in content creation workflows.

Usage and Feedback during the Testing Phase

Six people took part in each of the questionnaires for weeks 1 and 2, and four took part in the questionnaire for week 3. Most used the Content Wizard at least once a week during all three weeks and a third of participants used it 2-3 times in week 1 and 2 (see Fig. 12).

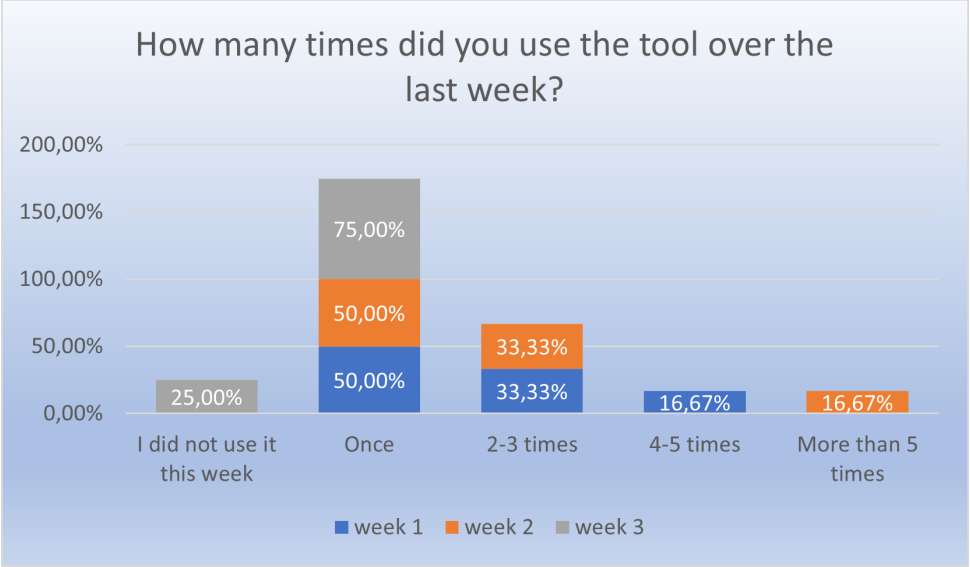


Figure 12: The frequency the participants used the Content Wizard during the test phase.

During the three week period, the **Planning Calendar** and the **Trending Stories** were the most used features (see Fig. 13). Since we observed that topic selection is the most time-consuming task in the current workflows and that participants make use of alternative solutions for it, these results highlight the potential of the unique proposition offered by the ReTV approach for topic selection. Video Search and Video Summarisation were the least used features - as already mentioned, this is likely due to the fact that participants are more accustomed to handing over the video search and editing tasks to other colleagues.

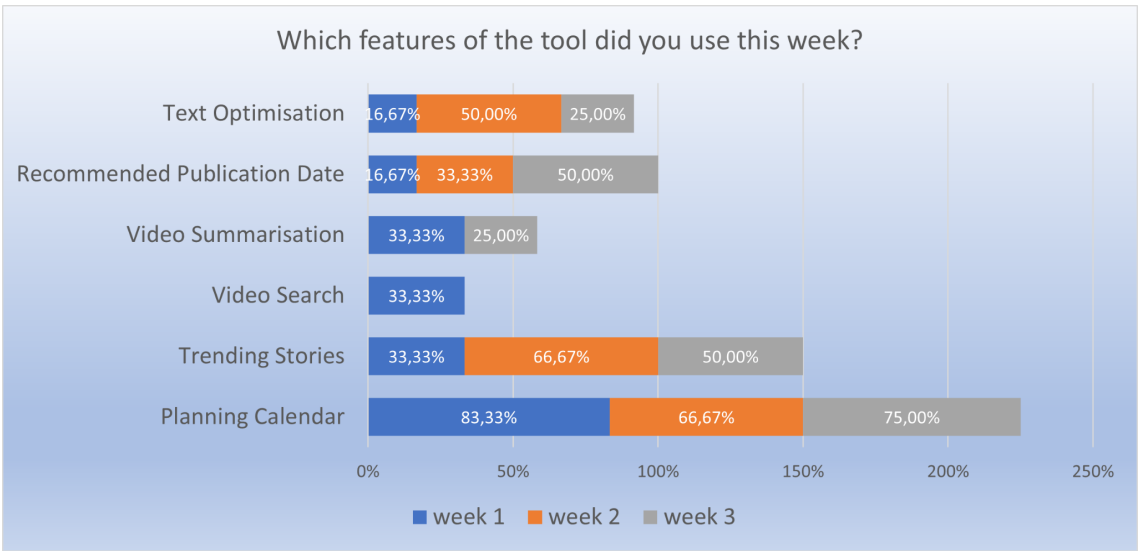


Figure 13: The features the participants used during the first three weeks.

Depending on the features used, participants were asked to rank them in terms of their usefulness each week. Unsurprisingly, the results correspond to the frequency of their use. The **Planning Calendar** was found to be the **most useful** tool during all three weeks (see Fig. 14). **Trending Stories** was also ranked in the first two places with comparably constant values (see Fig. 15). With regard to the other features, it is difficult to make general statements, as their use varied significantly during the test period. What can be said, however, is that each feature was ranked in the top two places by at least one participant for at least one week.

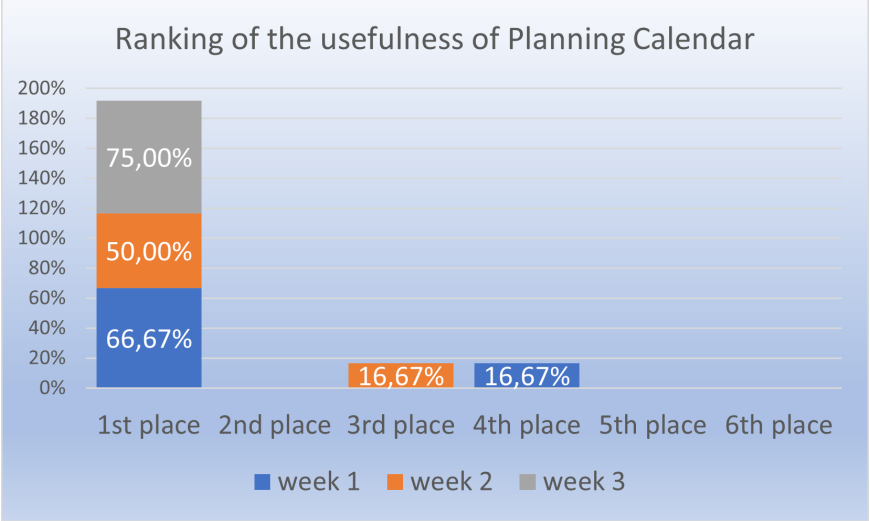


Figure 14: The ranking of the usefulness of Planning Calendar per week.

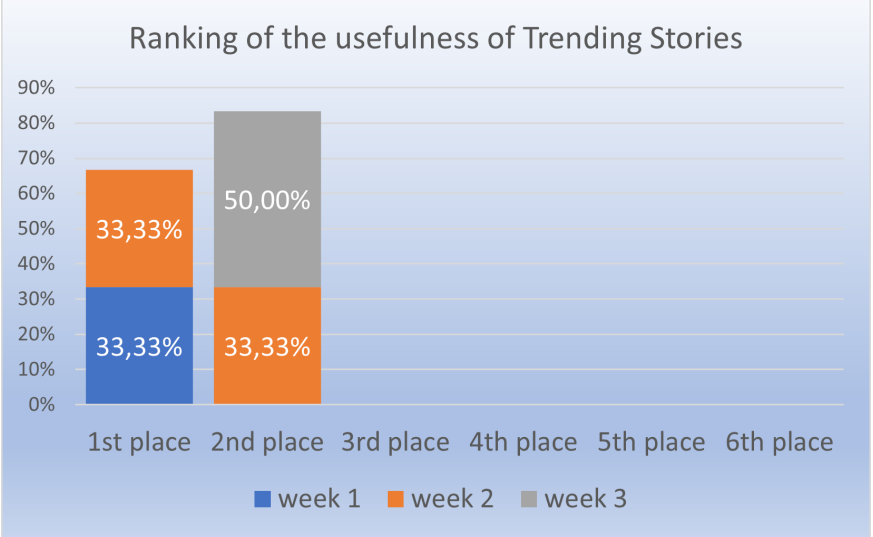


Figure 15: The ranking of the usefulness of Trending Stories per week.

Content Wizard overall

At the end of the test period, when asked to rate their overall experience with the Content Wizard on a scale from 1 to 5, where 5 is the highest score, half the participants rated it as 4, as can be seen in Fig. 16. The rest of the results were evenly distributed over 1 to 3.

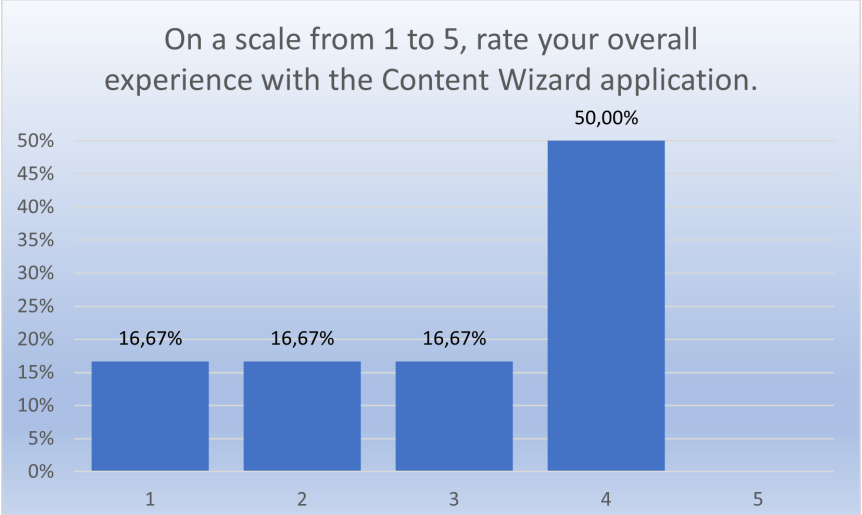


Figure 16: The rating for overall Content Wizard user experience, with 5 being the highest possible score and 1 being the lowest.

Regardless of the current quality of the results, the vast majority (83%) of participants agreed that the tool would **help them with their daily tasks** (see Fig. 17). Half of them strongly agreed that the tool would help them plan content releases in advance. All participants agreed that they would only like to use certain functionalities of the tool in their already existing workflows. Overall, we can remark that the tool would have a positive impact on the reuse and distribution of audiovisual content online.

It is interesting to observe that while the video retrieval and summarisation features were not used extensively during the testing period, the majority of participants agreed that the tool would help them publish more audiovisual content in a more efficient manner. This speaks to the fact users would be interested in using these features after additional improvements.

The opinion of participants was equally divided on the potential of the text optimisation feature, with 50% agreeing it would help them save time on text creation, while the other 50% disagreeing with that same statement.[7] Since most users do not already use similar solutions, we can conclude that not every content publication workflow requires it and that the feature could be offered to customers who need it specifically.

[7] It should be noted that in one of the instances of Content Wizard used by three participants we experienced technical issues with the Text Optimisation feature at the beginning of the testing period therefore they did not report using the tool in week 1. Because of this, their testing period was extended and they received the week 2 survey after the issue was solved.

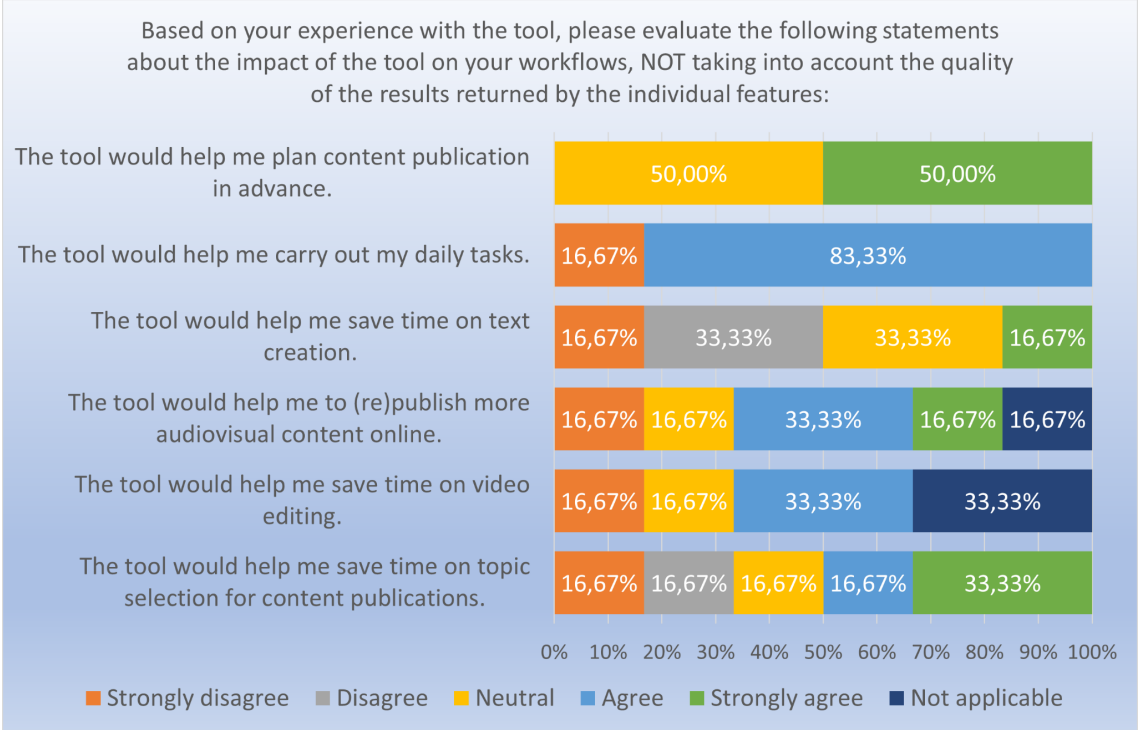


Figure 17: Impact of the Content Wizard on the participants' workflows.

When asked **what they liked best about the tool,** two out of six participants mentioned the Planning Calendar because it seamlessly brings together and visualises different sources of information and immediately suggests interesting topics for each day and allows users to create engaging content for social media. Two participants also mentioned Text Optimisation as well as Trending Stories as their favourite features.

When asked **what they liked least about the tool**, participants mentioned that further optimisation of data quality and improvements in the interface are needed across all features. It was mentioned that some features did not fully fulfil the needs of the participants due to different editorial teams having different requirements, for example the fact that content publication strategies need to be defined by their target audiences. These comments are likely due to the fact that participants from different departments were asked to use the same configuration of Content Wizard. Users mentioned that the Video Summarisation functionality would benefit from being supported by audio analysis and editing functions, a feature that was already on the roadmap for future development.

Usability

With regard to the usability of the Content Wizard, it can be said that the participants had no problems getting started with the tool. Two thirds of them disagreed with the statement "I needed to learn a lot of things before I could get going with this system" and 83% said that they did not need the support of a technical person to be able to use the tool (see Fig. 18). The majority of participants (67%) were also convinced that others would quickly learn to use the tool.

The large majority of participants could not clearly answer the question of whether the system was easy to use, 83% voted with neutral. With 50% each, this was also the dominant answer regarding the statements "I thought the tool was too complex" and "I thought there was too much inconsistency in this system". However, a tendency towards "disagree" can be seen here,

as one third of the participants also voted for this option each. This indicates that further improvements are needed to make the tool more intuitive and user-friendly, and enable users to fully benefit from its capabilities.

In terms of participants' confidence using the tool, the answers were rather heterogeneous but nevertheless leaning towards a positive response, with 50% agreeing with the statement. The same applies to "I found the various features of the tool were well integrated to support my workflows" and "I found the system very cumbersome to use". "I would like to use this tool in my daily workflows" is the only statement on usability that was not rated as neutral by anyone. 50% of the participants (strongly) agreed and 50% (strongly) disagreed. As we already observed, given the diversity of workflows and the level of professionalisation represented in the group of testers, it is expected that not everyone's needs would be completely fulfilled.

Finally, there was an agreement on the usefulness of all functionalities for content creation, editing and publication in one tool. 50% of the participants voted with 'agree' and one third with 'neutral'.

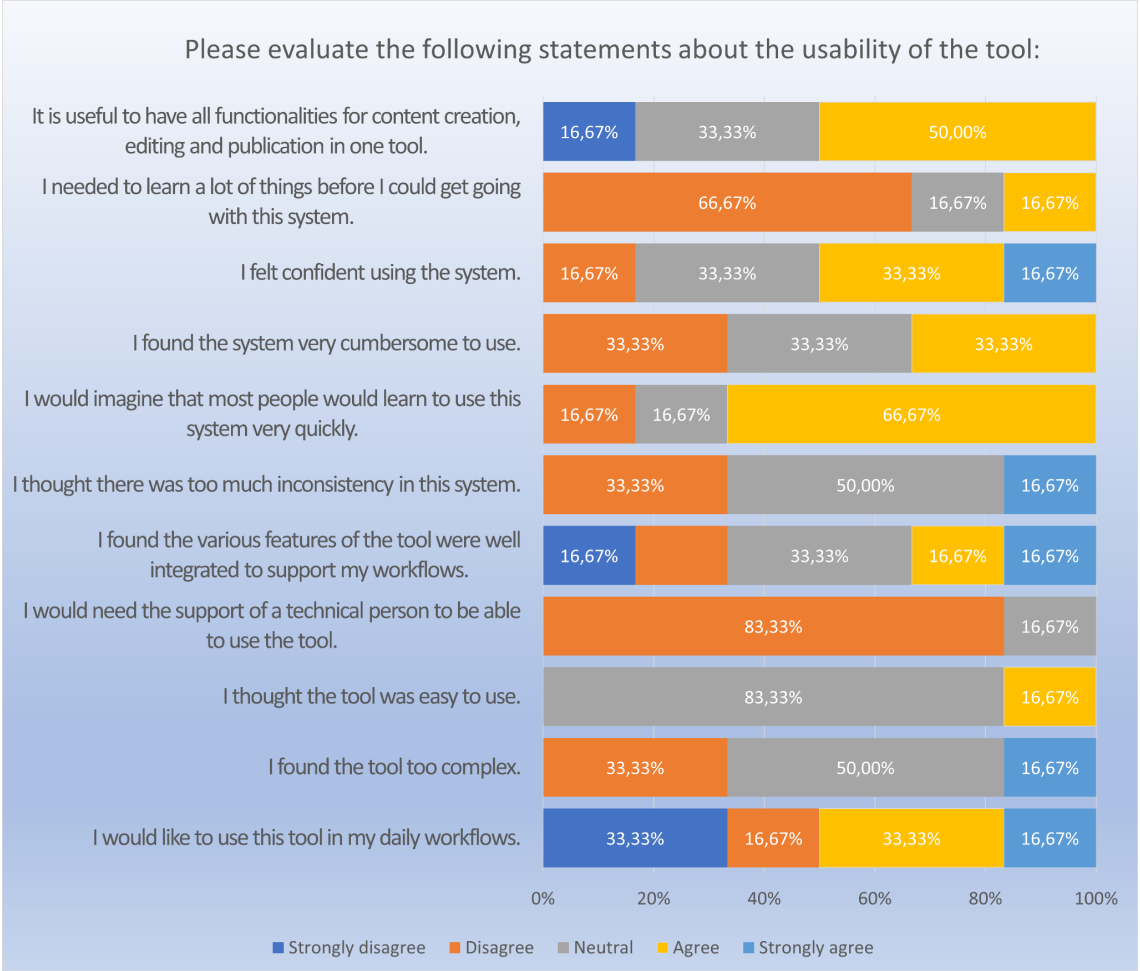


Figure 18: Usability of the Content Wizard and its features in editors' workflows.

Participants were also asked to provide adjectives that would describe their overall experience with Content Wizard. Two of them mentioned that the tool was *useful*, others indicated that it was *timesaving, inspiring, efficient* and *productive*. Two participants also mention that Content Wizard needs to be *improvable* which implies that the full potential of the application could be

fulfilled with further improvements to the configurations and user interface. A couple of participants added negative adjectives to describe their experience, mentioning that it was *error-prone, complicated* and *not tailored to their needs.* Given the sum of these positive and negative comments, we can conclude that the usability of the tool is tied very closely to the configuration that is required by each user.

When asked about the usefulness of individual features for their current operation workflow, the Planning Calendar was found to be the most useful of all the features (see Fig. 19). Text Optimisation received a lower rating, which was to be expected, as a number of testers claimed they did not need the tool for their daily work.

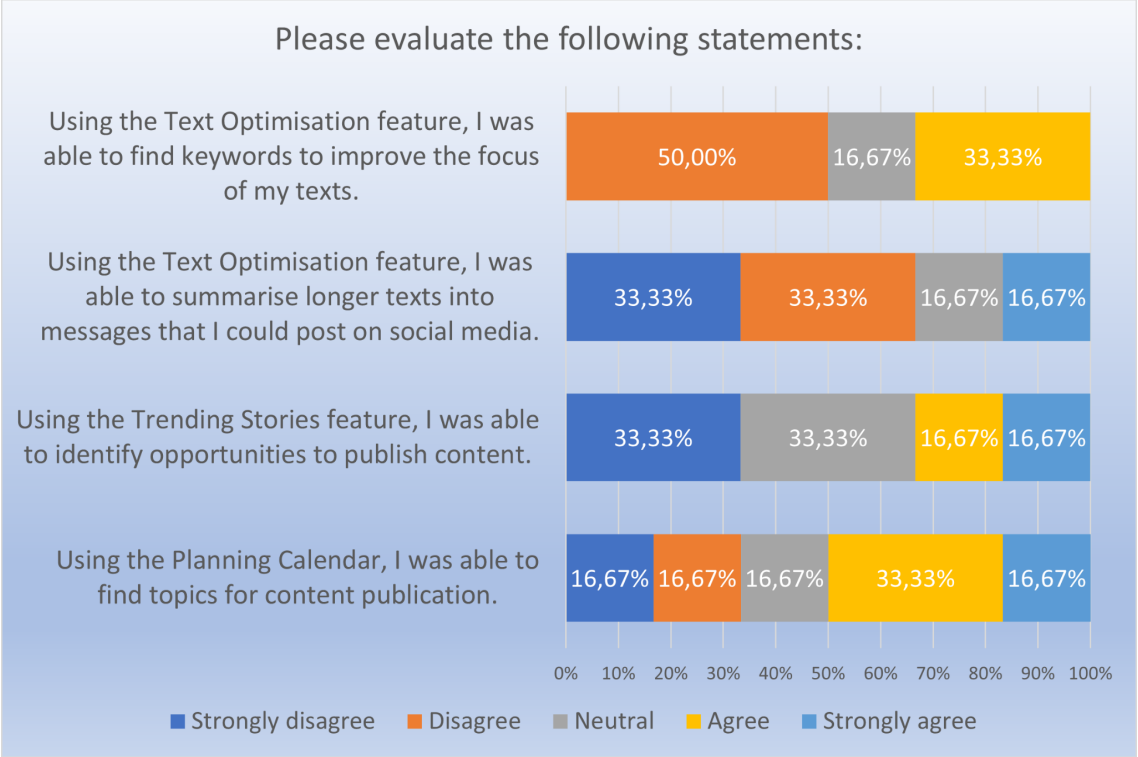


Figure 19: Usefulness of Text Optimisation, Trending Stories and Planning Calendar in editors' workflows.

All participants who used the video retrieval and summarisation features stated that they would do additional editing after the summary was generated (see Fig. 20). Interestingly, it seems that most users would require additional advanced video editing tools as the parameters for adjusting the length, range and cut frequency did not seem to satisfy their needs, with only 25% evaluating this feature positively. This would also help to improve the overall quality of video summaries as 75% stated the generated summaries were not fully representative of the full videos; the automatically-generated summaries are a good starting point but the users valued the possibility of further modifying them to convey their intended message.

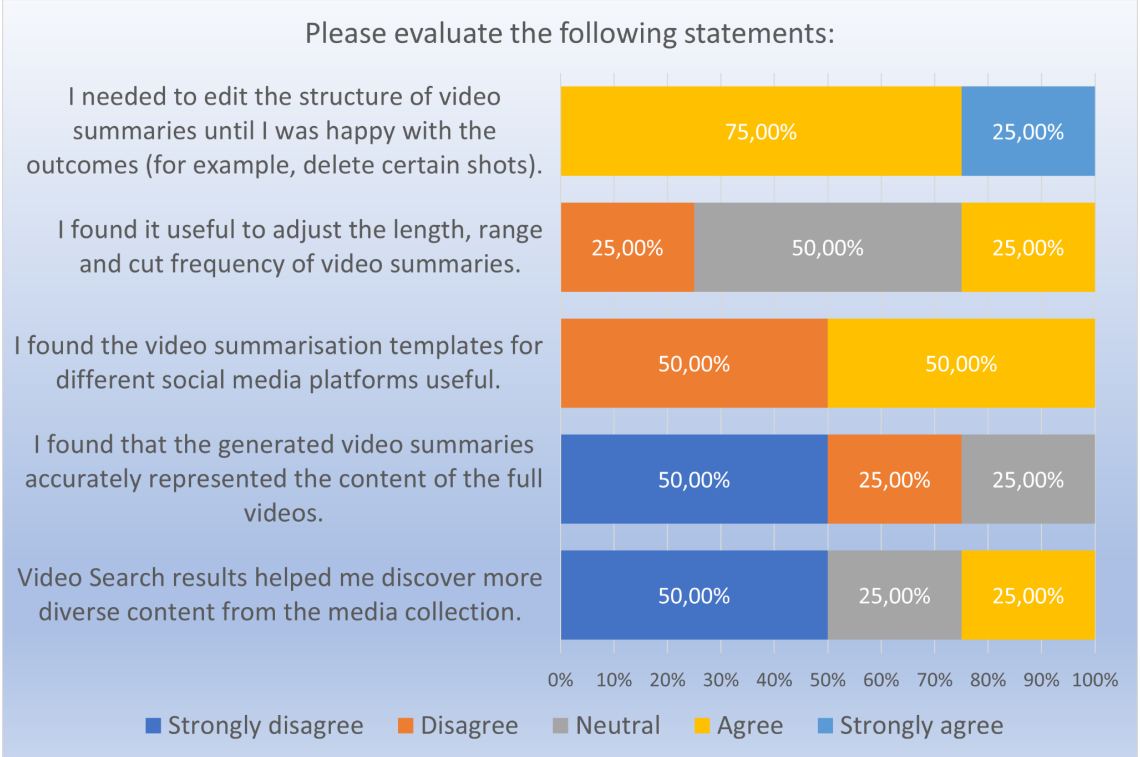


Figure 20: Usefulness of Video Summarisation and Video Search in editors' workflows.

Future Improvements

Below we present more detailed qualitative feedback on each feature and suggestions for their improvement.

Planning Calendar

- Most users found the quality of the results satisfying during the whole testing period. Participants positively evaluated the fact that they can immediately get suggestions for topics;
- Further customisation is needed to improve the relevance of events. This could be done by user-specific integration of databases used internally. Additionally, currently event titles and descriptions were only available in English, this should be customisable per use case;
- Users would like to manually remove the events they are not interested in from the calendar and highlight the ones they are interested in (e.g. assign an event to a campaign);
- The list of events for each day could be prioritised by the availability of relevant content in the media collection.

Trending Stories

- This feature was seen as potentially the most interesting tool of the Content Wizard and useful for planning as the participants currently do not have any tools with comparable capabilities available to them;
- Participants favoured the narrative-based visualisations storygraph and tag cloud (to find hashtags) as well as the keyword graph (to find a story within a story);
- The transparency could be improved - for example, users could not see what terms were used to define the bookmarks as this is only visible in the full Topics Compass dashboard;

- Users also found it difficult to assess the quality or reliability of the predictions. It was suggested that more precise filtering should be included as well as testing over a longer period of time to see if the predicted trends come true;
- Participants suggested that filters could be added to analyse data by target groups.

Video Search

- Unfortunately, Video Search was only used in week 1 and its results were found to be unsatisfactory. The majority of the participants said that they wanted to use the search for queries related to specific persons, locations, etc. Given that the search is built around concept detection, it is expected that it would not work for persons and names. But since users are highly interested in this feature, a hybrid search approach could be adopted in the future, combining the results of the current approach and regular search over video titles and metadata. Participants suggested providing better control in terms of search (e.g. editing the query or manually add additional search terms);
- It would be important to connect Content Wizard with media asset management systems and display more extensive metadata categories, especially about legal restrictions. While this was not possible during the testing period, this approach is foreseen during the commercialisation of the tool.
- One participant suggested that preview videos could also be displayed in the search results to help users make a choice. Video summarisation service could be used.

Video Summarisation

- For most of the participants, the idea of the Video Summarisation feature in general was seen as a potential help for their daily work. Others stated it was no longer considered essential as their organisation had a dedicated department specialised in video editing who would take care of this using professional video editing software. We foresee that in such cases, video summarisation service could be used as a standalone service to allow for a more granular configuration (see Chapter 5 where this is discussed);
- The ability to change the order of segments within a summary was rated very positively as users do not feel the need to stick with a chronological ordering of shots when they do manual video creation;
- Participants noted that since the conception of the ReTV project, the need for muted videos has diminished therefore audio analysis and editing features should be a priority for future development;
- The available options for manual video editing could be further improved by expanding the interface to provide functionalities currently available in standard video editing software. Additionally, one user mentioned that they would like the opportunity to define their own presets for different types of programmes based on the more extensive video summarisation parameters (this relates to Chapter 5 where we present how video summarisation service could be employed as a standalone application).

Recommended Publication Date

- The concept of getting a recommendation for the optimal publication time of a social media post was evaluated as excellent. However, during the tests, the feature did not work in the way the participants expected, i.e. they reported that the most usually recommended date was today or the last day of the month. An assessment of the data determined that the results are correct. Indeed a major part of the gathered content references today (events that happen in just a few hours) or the end of a month/year (since this is when a lot of processes are completed or deadlines expire). To address the

first perceived shortcoming, we are going to limit the available data range to a certain number of days in the future (e.g. from +5 days onward). Using the metric "Share of Voice" instead of "Frequency" will address the second, as it normalises against temporal fluctuations and projects the relative importance of topics.
- The interface should be improved to make the recommendations more transparent. This could be done by displaying data sources that point to the suggested date.

Text Optimisation

- The text summarisation feature was found to be particularly useful for creating social media posts out of longer articles or blog posts. The suggestion of new terms appears to offer more benefit to web texts than social media texts as SEO and Google search metrics are not relevant for social media platforms;
- Some users indicated that text is not of crucial importance for their social media posts as the focus is on images and videos. Others argued that creating a "catchy" message to accompany their media content was very important and they would use the feature to identify keywords to include in their posts.

Participants indicated that alongside the already existing capabilities of the Content Wizard, they would like to have additional features such as a music database, community/social media management (for replying, deleting and blocking comments), a search function to find related content in other social media channels (e.g. CrowdTangle), statistics on social media posts, the possibility to switch between different sources of information and a function for planning in which individual notes could be entered.

Based on the results of the tests, future developments for the Content Wizard should possibly focus on offering it as a modular application, tailored to suit the individual requirements of customers. Support for granular customisation based on the goals of each team, their target audiences and their content is key. The results also suggest that the tool may be more suitable for smaller organisations and teams that do not necessarily have access to a full range of professional media editing tools.

4 Topics Compass

Topics Compass is a visual data exploration and analytics dashboard that assists media professionals in (i) identifying opportunities to reuse and promote audiovisual collections, (ii) guiding content creation through data-driven insights (see Fig. 21). The tool enables users to monitor topics in content sources across platforms and channels and track their longitudinal development, including their forecasted popularity at a given future point in time.

Topics Compass targets advanced users who want to perform more extensive analysis of data sources than what is possible using its *Light Version* embedded into the Content Wizard (the Trending Topics feature, see Section 3.2). The tool provides three main advances compared to other similar solutions on the market:

- real-time analysis and visualisation of stories from cross-platform, multilingual data;
- capability to forecast topics that will be relevant in the future;
- analysis of data using a rich set of automatically extracted metadata attributes, for example, affective knowledge such as sentiment and emotions, or customized brand-specific success metrics.

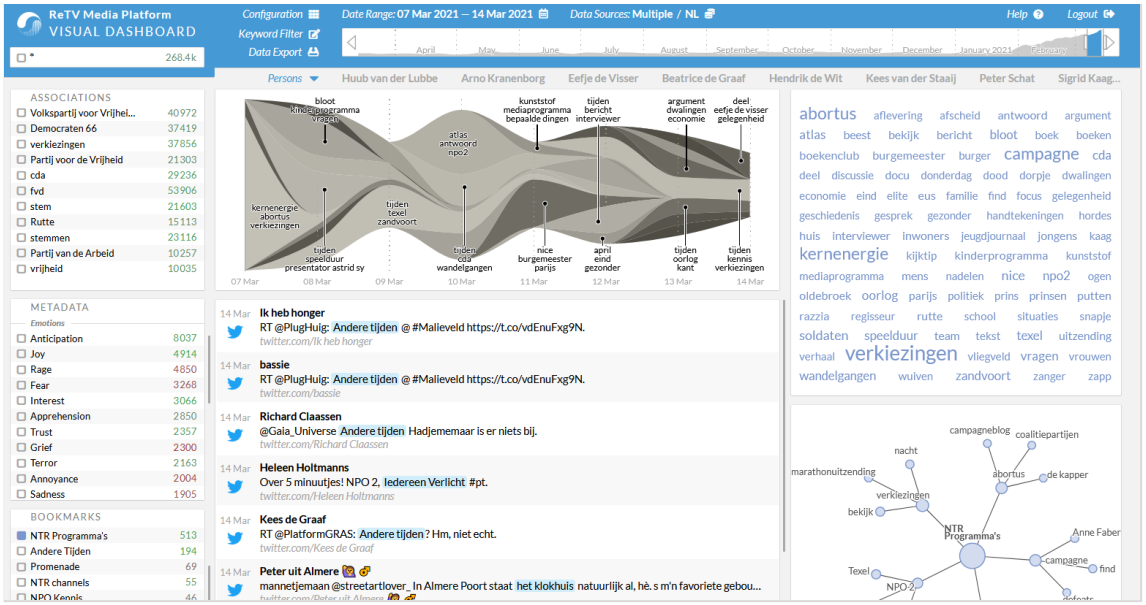


Figure 21: Topics Compass dashboard with Dutch Twitter content

The following sections first describe the scenario development since the first evaluation with professional users and provide a detailed description of the final functionalities. We close the chapter with feedback from professional users on the potential of the tool in their workflows.

4.1 Scenario Development

The first version of the Topics Compass application was evaluated and presented in D5.2. It already had the main features for real-time data monitoring and analysis, and the concept for predictive capabilities which were under development at the time it was presented. The evaluation of this initial prototype highlighted two key points that guided further implementation work:

- users want an easy way to interact with the dashboard and extract the necessary information at a glance;
- users want to customise all features of the dashboard to their specific needs.

Taking this feedback into consideration, the development of the Topics Compass continued in two strands: (i) a *light version* of the dashboard integrated into the Content Wizard would be available for users interested in a quick overview of trends and stories, and (ii) users interested in more extensive analysis and customisation would use the *full version* of Topics Compass.

Table 3 below summarises further user comments on Topics Compass gathered during the first evaluation process and describes how they were addressed during the implementation.

User Comments	Implementation Approach
Users want a user-friendly interface design.	Optimisations of the interactive controls, interactive help function in the header as well as a new mobile version that provides a simpler, more linear user experience. The mobile version is also embeddable into external applications such as the *Content Wizard.*

Users want more control over the results provided by the dashboard.	A keyword filter that allows users to remove irrelevant or inappropriate keywords, accessible via the header menu, distinguishing a persistent and sessions-specific stoplist with the capability to move terms between both lists.
Given the complexity of the tool, users need effective training materials.	A continuously updated user manual is accessible through www.weblyzard.com/interface, modular enough to support multiple workflows. The manual cross-references various showcases and documents the available data services and visualisations. For specific use cases, industry partners prepared step-by-step scenarios showcasing the capabilities of the dashboard (see Appendix C).

Table 3: User comments on Topics Compass from the first evaluation process and ReTV approach for their implementation.

For a detailed description of how the TVP components are used in the Topics Compass, see Section 4.1 of D4.3 *Trans-Vector Platform, Final & Optimized Version*.

4.2 Final Prototype

The Topics Compass workflow can be broken down into three main steps: (i) configuring the dashboard, (ii) defining the search focus, and (iii) analysing and exploring results via data visualisations.[8]

Step 1 - Topics Compass Configuration

Each time they log into Topics Compass, users are presented with the configuration pre-defined for their specific requirements, which can also be adjusted while using the tool. The following are the key settings that help the user to configure the dashboard for specific scenarios:

- *Time Axis* allows the user to switch between the **Listening Mode** (based on publication dates) to analyse data sources published during a certain period of time, and the **Prediction Mode** to identify future events referenced in digital content sources (see Fig. 22);

[8] See video tutorial at go.weblyzard.com/dashboard-tutorial.

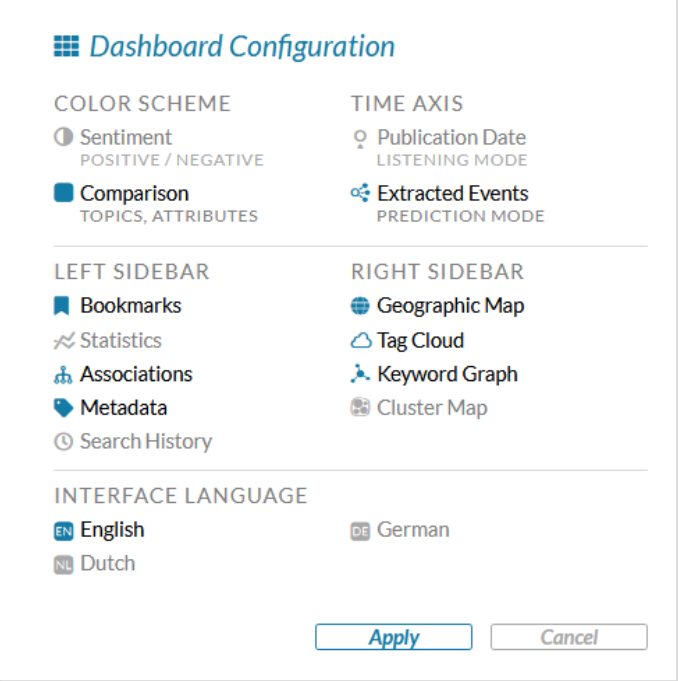


Figure 22: Topics Compass configuration options.

- The user can choose between the following **data visualisations** which will be displayed on the right side of the dashboard:
    - *Geographic Map* maps the locations referenced in the documents as well as source locations. For example, it can be used to understand which locations are associated with a particular news story;
    - *Tag Cloud* provides an alphabetical ordering of extracted keywords. Colour coding is used to compare keywords associated with several bookmarks or metadata attributes, and visualise the results along different semantic, e.g. sentiment or emotional categories;
    - *Keyword Graph* displays the strongest associations between the keywords extracted from the documents. This more structured way to display keywords allows the user to identify a particular story within their general search topic.
- The user can choose between the following **data sources** available in multiple languages (English, German, Dutch and French):
    - *News Media* - articles from news outlets including international, national or statewide coverage;
    - *Social Media* - Facebook, Twitter and Youtube posts from particular accounts and posts that mention keywords relevant for the user. For example, a user interested in following discourse around elections in their country would follow accounts of political parties and personalities as well as posts any posts that mention names of these political parties and persons;
    - *TV/Radio* - television and radio websites, both private and public, regional and national;

- *Misc* - A diverse set of miscellaneous websites including regional news outlets, blogs, trade publications, newsworthy domain-specific sites, NGOs, cultural organisations, community platforms, etc.

Step 2 - Defining the Search

Users specify their searches by entering a single search term into the search bar or selecting a **bookmark,** which stores a more complex search query. Boolean search operators can be used to clearly define the scope of the results and eliminate unrelated data. The following provides examples of how bookmarks can be set up by Topics Compass users:

- an editor or curator from a media archive could set up a bookmark to monitor currently trending stories (e.g., climate crisis, COVID-19 pandemic, local elections) for opportunities to promote related archival videos. To define the bookmark specifically for their use case, they could use keywords and entities from their audiovisual collection (e.g. focus on the personalities prominent in their media content);
- a broadcaster using Topics Compass can create a bookmark with a list of TV programme titles. This would allow them to monitor any documents that mention these titles, and analyse emotions, sentiment and desired/undesired terms associated with them in order to gain insights on how to tailor future content to achieve specific impact. If a title of a programme is a rather generic term, the user can use the boolean search operators to focus the search results on documents that mention this title alongside other keywords (e.g. presenter's name or the name of the channel).

The user can also use the **Keyword Filter** function to define terms that should be excluded from the search results. This is necessary to eliminate generic or irrelevant terms (see Fig. 23). To make this feature more user-friendly, the user can now click on any keyword in the dashboard's visualisations and exclude it from the search results, as well as enter the terms manually. These keywords can be added to a temporary list that applies during one session or a permanent list that excludes that from all future searches.

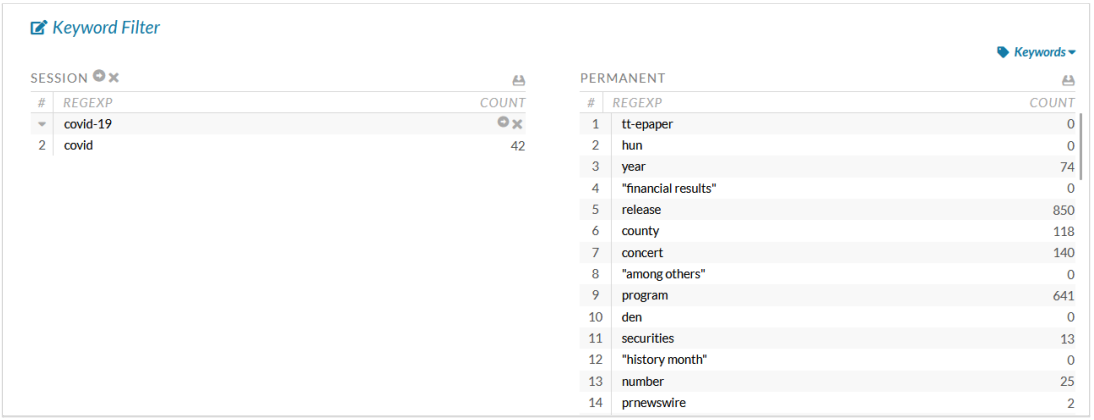


Figure 23: Topics Compass keyword filter, with session-specific stoplist terms on the left and a persistent list on the right that will remain active for a user until actively deleted.

Step 3 - Data Analysis

The dashboard supports different types of information seeking behaviour, including browsing, searching and trend monitoring. The following lists the main data visualisation features that address the needs of media professionals.

Share of Voice visualisation presents a relative number of times a selected topic was mentioned in the data sources (see Fig. 24). The graph is normalised for naturally occurring fluctuations, for example, a drop in activity over night, during the weekend or the holidays. In the prediction mode, this can be used to easily identify what topics will be popular on a given day or alternatively, find a day to publish a given piece of content with the highest impact.

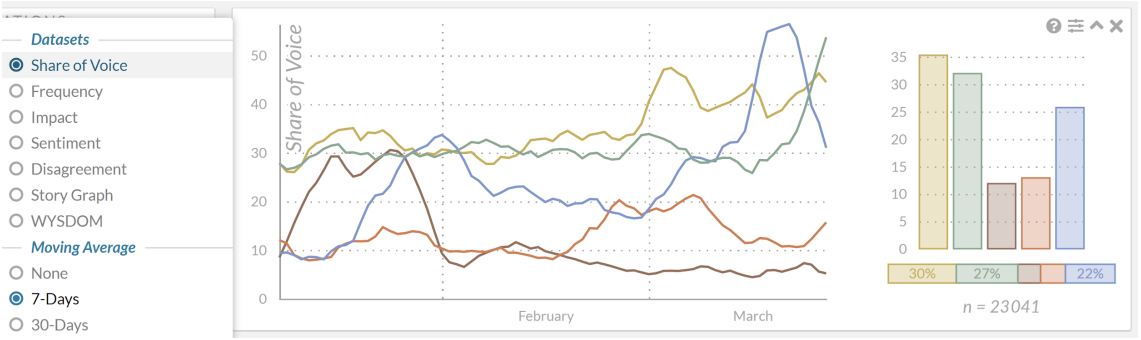


Figure 24: Share of Voice graph in Topics Compass.

Storygraph visualisation groups related documents into a story. This provides a narrative-based way to explore data sources. Each story is represented by three keywords (see Fig. 25).

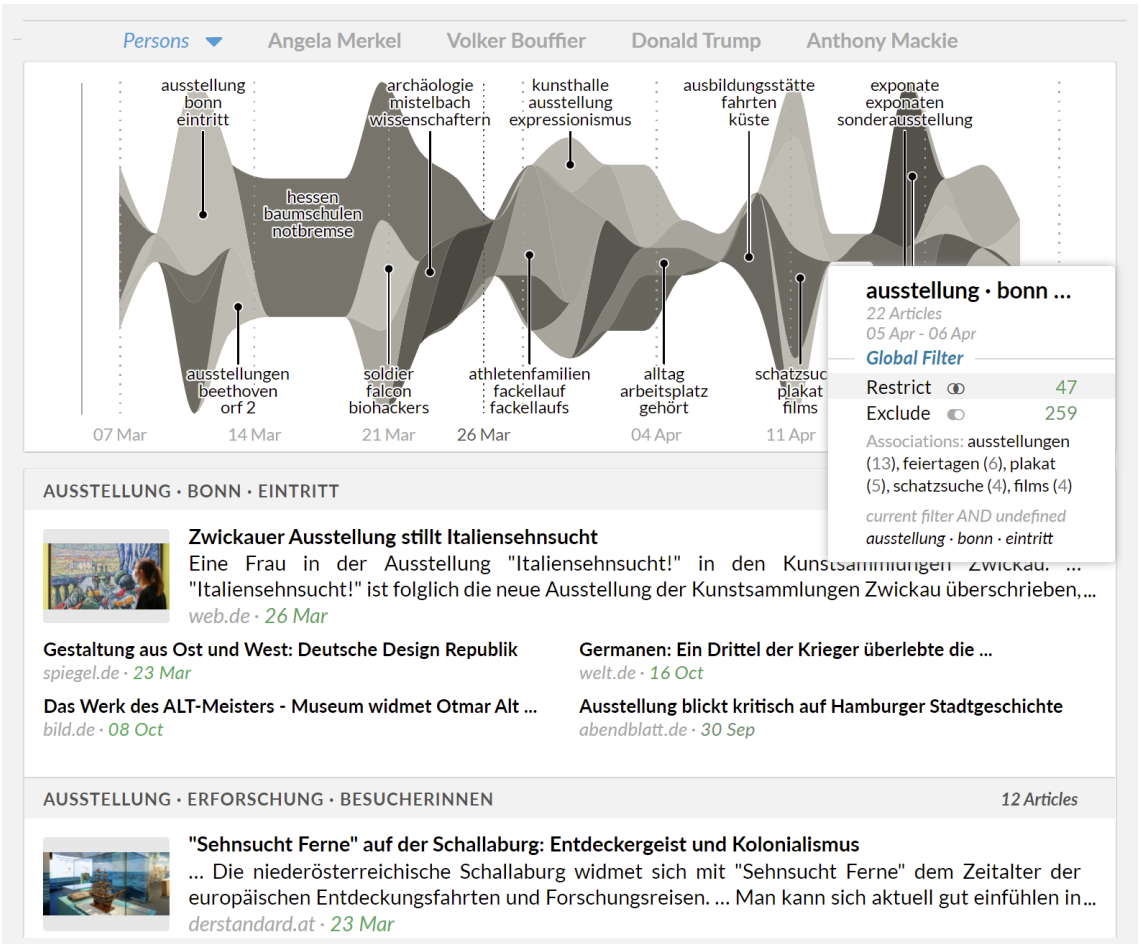


Figure 25: Story Graph visualisation for a bookmark that tracks German art-related documents. As the user hovers over a particular story on the graph, documents related to it are highlighted below.

WYSDOM visualisation allows users to inspect documents against success metrics specific to their strategy. Unlike sentiment analysis, WYSDOM analyses content using *desired* and *undesired* qualities defined by each user. For example, a broadcaster promoting an action-based TV series would want to monitor if its viewers refer to the show as exciting or slow and boring. For this, they could either define their own list of desired and undesired terms or make use of emotion analysis (described below). The insights from this visualisation can be used to adjust content creation strategies in order to avoid undesired impact on audiences.

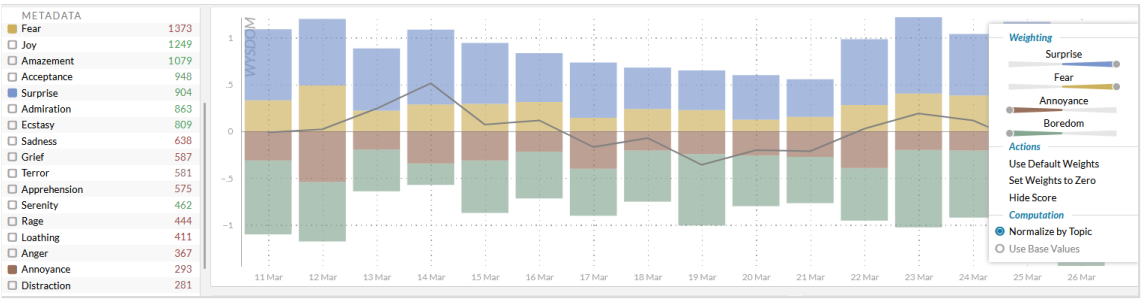


Figure 26: WYSDOM visualisation in Topics Compass. Here, documents that express surprise and fear are considered as desired, while annoyance and boredom are undesirable reactions from the audience.

Emotion analysis allows users to classify documents according to the emotions they express (see the left side of Fig. 26).[9] For example, depending on their content strategy, a user might want to focus on stories that are highly anticipated by their audiences, or find documents that evoke rage or fear.

Tag Cloud displays an alphabetical list of terms associated with the selected search query. Colour-coding allows users to compare terms associated with multiple topics. For example, a user could compare keywords that audiences on social media are using in relation to two different programmes. This can be particularly useful to better understand how audiences perceive these programmes and which topics they are interested in. Additionally, this can provide insights into which keywords to use in content publications to increase their reach.

Keyword Graph provides a hierarchical display of keywords associated with the search query (see Fig. 27). This visualisation is particularly useful when a user starts the search with a broad topic and wants to narrow it down to a particular aspect of that topic by focusing on one of the "branches" within the graph.

[9] Based on the Plutchik's Wheel of Emotions classification, see Plutchik, R., A General Psychoevolutionary Theory of Emotion, 1980, https://doi.org/10.1016/B978-0-12-558701-3.50007-7

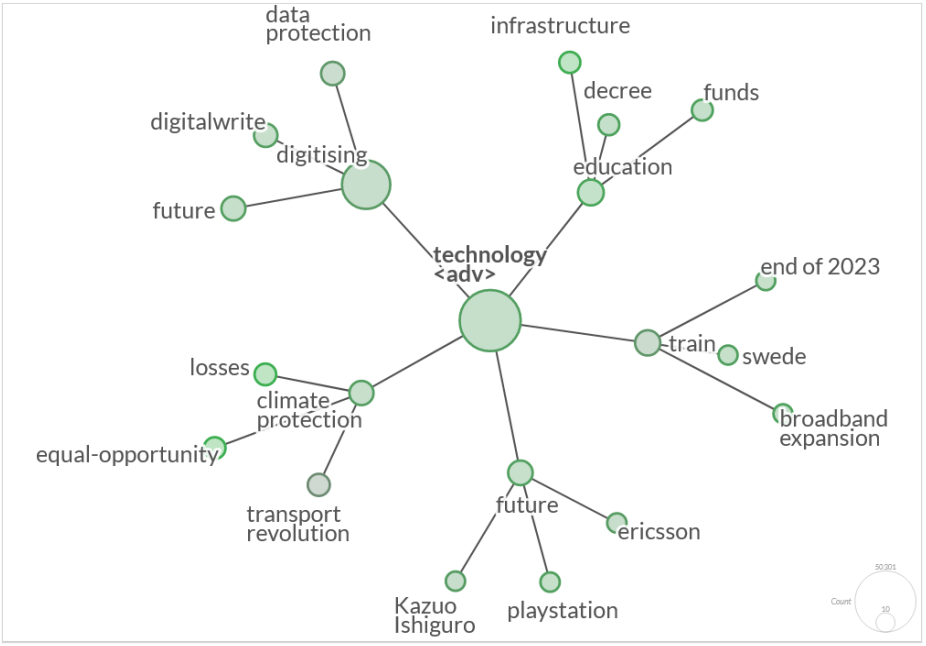


Figure 27: Keyword Cloud visualisation in Topics Compass for an example scenario where the user is interested in monitoring news discourse related to technological innovations. The green colour indicates that the reported stories are associated with a positive sentiment.

4.3 Evaluation Results

To evaluate Topics Compass, NISV and RBB continuously used the application as soon as the first version of the Prediction feature was implemented. They showcased the tool in meetings with their colleagues and external media organisations, as well as provided demos during public conferences and online events.[10] New bookmarks and data sources were continuously added based on the topics that were emerging in the media throughout this period. This evaluation approach enabled us to (i) assess the capabilities of Topics Compass against a wide range of scenarios over a long period of time, and (ii) gather feedback from a wide selection of media professionals on specific examples and scenarios prepared by the use case partners. Throughout this process we specifically focused on the following two aspects:

- the **scenarios** in which the Topics Compass would generate the most value and support the reuse of audiovisual collections;
- the type of **configurations** different stakeholders would need to gain meaningful results.

For example, to evaluate the application with Dutch media organisations, an instance focusing on Dutch data sources was created. Keywords related to popular Dutch TV programmes were added to the list of content sources (see Fig. 28). Using this configuration, we were able to demonstrate to professionals from broadcaster organisations how they could monitor content

[10] This includes events for media professionals such as the Cross Media Cafe organised by the Netherlands Institute for Sound and Vision in April 2020 (https://mediaperspectives.nl), the Conference on Theory and Practice of Digital Libraries August 2020 (http://eric.univ-lyon2.fr/adbis-tpdl-eda-2020/tpdl/), Informal Virtual Audio Visual Summit organised by the Library or Congress in September 2020 (https://labs.loc.gov/static/labs/events/documents/IVAV-Agenda-09142020.pdf), the joined IASA/FIAT IFTA conference for audiovisual archives in October 2020 (http://fiat-iasa-2020.org/).

related to their programmes in order to better understand their audiences and the perception of their brand, and improve the performance of their future publications.

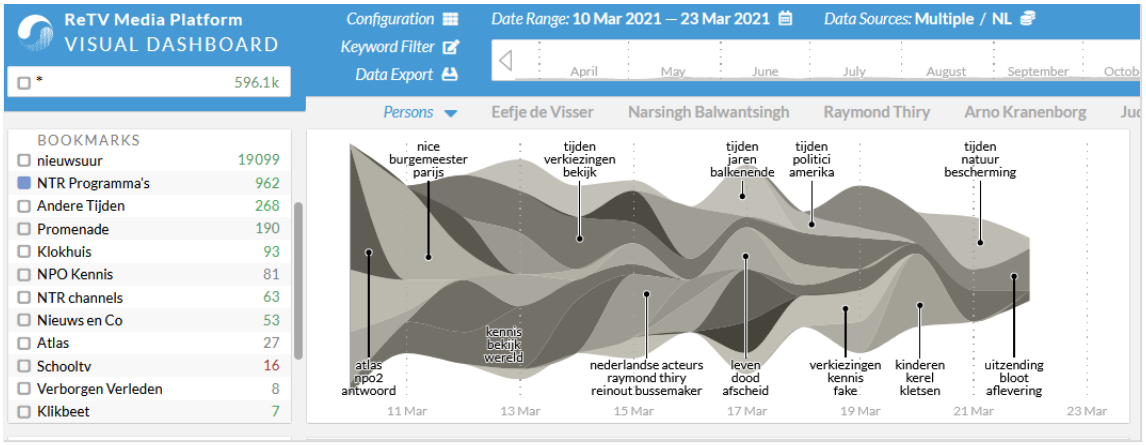


Figure 28: Topics Compass instance configured for Dutch media professionals. In the top left corner, bookmarks related to popular Dutch television programmes are provided.

In the first half of 2020 leading up to the Eurovision song contest hosted in the Netherlands, keywords and data sources related to this event were gathered. The scenario covers a large geographic area and would fully benefit from the cross-lingual analysis and geo mapping available in the Topics Compass. For example, a user could monitor the "buzz" around different countries and use it as an opportunity to republish videos related to the past performances of those countries (see Fig. 29). Project partners were planning to invite journalists, media researchers or amateur enthusiasts who were creating content about Eurovision to use Topics Compass during the months leading up to the event and produce content related to it. However, due to the COVID-19 and the cancellation of the live event, it was decided not to proceed with these plans. Nevertheless, given that the dashboard is already tracking relevant content, it could be easily provided to users interested in this topic in the future.

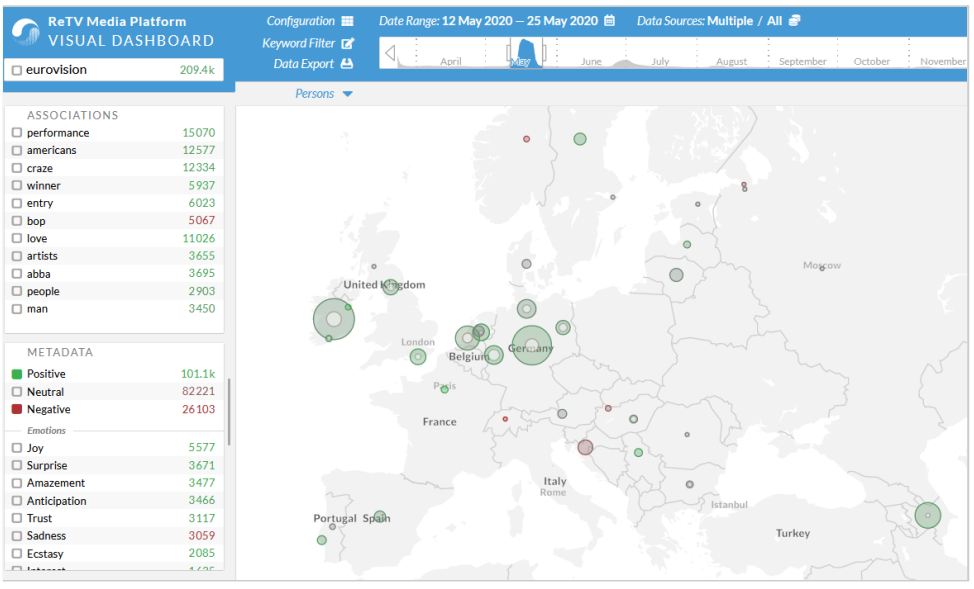


Figure 29: Topics Compass instance visualising documents related to the Eurovision Song Contest in 2020. The GeoMap visualisation can be used to monitor the "buzz" around each country's entry and the sentiment associated with it.

In January 2021, we started crawling documents related to the upcoming general elections in the Netherlands (held on 15-17 March). This presents an interesting use case as it is a topic that requires close and constant monitoring given that during a short period of time leading up to the elections new stories were constantly emerging and data coming from social media platforms could be used to monitor how Dutch citizens reacted to them. As an example, media organisations could use insights from such data to closely monitor topics that were causing tension or disagreements, and use their archival content to contextualise those issues (see Fig. 30).

Figure 30: Tag Cloud to compare the relation between societal topics and political parties. Based on a search query "climate crisis", with colour coding to compare keywords associated with three political parties represented in brown, yellow and blue (grey colour denotes keywords related to all parties).

Additionally, a number of bookmarks were created to monitor documents around specific topics that emerged to prominence throughout the period, including misinformation, technological innovations (5G, artificial intelligence), COVID-19, Women's History Month, Black History Month, LGBTQ.

In the following sections we present feedback on Topics Compass based on the scenarios as the ones described above. This includes both qualitative feedback from external stakeholders as well as observations from NISV and RBB gathered during the preparation of these scenarios.

Usage Scenarios

The consulted professionals indicated that they use both the Publication Data Mode to monitor stories from the very recent past (the last week) as well as the Prediction Mode to plan their publications for the immediate future (no more than the next two weeks). Some said they would be interested in monitoring trends over time, but in most cases, the focus was on finding a story that is trending today or on a specific day in the future.

It was observed that the Prediction Mode works best with features that allow users to explore documents along their temporal qualities. For example, a user might initially select a time range of two weeks and then explore particular days within this period without having to reconfigure their search results each time. The Recency feature available as one of the metadata categories already supports this (see Fig. 31). Here, the user can explore the search

results by ordering them from the oldest to the most recent, or from the most immediate to the most remote in the Prediction Mode.

Figure 31: Data sources organised by recency in Topics Compass.

An important aspect of using Topics Compass for all users was control and transparency. The ability to easily remove irrelevant associations using the Keyword Filter was evaluated very positively. One person who saw the light version of the dashboard integrated into Content Wizard said they would prefer using the full Topics Compass application as it allowed them to better understand where the search results came from and how to adjust different parameters to improve their quality.

During a meeting with one team at a broadcaster organisation, it became evident that while people from different roles could benefit from the tool, their needs were very different, particularly in terms of how deep they would like to go into the data analysis, how much detail and context they want to extract and how they would like to interact with the application. Users who are interested in producing reports on content metrics felt more comfortable with various exploratory features available in Topics Compass, whereas other users wanted to get results at a glance or have a step-by-step guide how to get from A to B.

For this reason, we created a number of exemplary scenarios that showcase step-by-step how the tool could be used to narrow down the search results from a generic query to very specific insights (see Appendix C for an example). We envision that organisations could have one “super user” who is fully trained to configure and use the dashboard and can distribute insights from it to their colleagues. Alternatively, members of the WLT team could provide this service.

Configuration

The quality and diversity of data sources available via Topics Compass were evaluated as one of the most attractive features. In particular, having social media posts alongside professional content from media organisation websites presents possibilities to better understand how audiences respond to news stories, which can then guide future decisions about content creation and publication.

In terms of the categorisation of data sources, a number of professionals pointed out that Twitter content could be separated into tweets and retweets which would enable users to easily exclude stories amplified by a single tweet. Additionally, during the experimentation with different scenarios, NISV identified that a more granular categorisation should be used for data that is currently in the Miscellaneous category as well as for social media accounts to increase the quality of search results. A thematic approach instead of the current platform-based

categorisation could be considered (e.g. categories such as culture, technology, sports, politics, etc.). To avoid the need to restructure the ingest workflow in order to accommodate this, such categories could be available as one of the Metadata categories. This would enable users to focus on documents from a specific domain and avoid situations where a particular phrase or keyword is interpreted differently in different contexts (particularly, this would help with getting more accurate results when querying for acronyms).

Nearly all professionals who were consulted pointed to the need for an agile way to add new data sources. Given the 24-hour news cycle, new topics constantly rise to prominence and users would want to query data related to them which requires crawling additional keywords on social media as well as adding new websites or social media accounts of importance. Currently, the process of adding new sources is not instantaneous and users need to contact the WLT team with their requests. While the quality control checks before adding new data sources is necessary and therefore not instantaneous by design, the process could be made more user-friendly by providing a form in the interface of Topics Compass where users could provide their requests for new data sources. Increased adoption of the platform in the exploitation phase would also create the resources to obtain access to the Enterprise API of Twitter, providing historic data beyond the 7-day limit that applies to the free service. This would enable instant searches on any desired topic.

News stories related to COVID-19 in particular presented a challenge as they started overshadowing the search results of seemingly unrelated topics or made some insights provided by the tool no longer valid (for example, when using Prediction Mode to look for upcoming events, many data sources pointed to cancelled events). In response to this, we updated the existing bookmarks to exclude documents related to COVID-19 which significantly increased the quality of results. As for Prediction Mode, we observed that even if the events were cancelled, they still presented an opportunity for media organisations to share related content (for example, republish content from last year's edition of the same event).

Visualisations and Data Exploration

Our conversations with professional users revealed that they favour narrative-based visualisation such as Storygraph and Keywords Chart that enable them to quickly review the search results and decide what they want to focus on. For the Tag Cloud visualisation, many consulted professionals indicated that it could be extremely useful if it could visualise only hashtags (e.g. hashtags that are used around a particular story).

In terms of data exploration, we observed more accurate search results when the number of data sources was narrowed down to a more humanly-comprehensible scale. Search results over hundreds of thousands of documents would often produce either very generic or very obvious results. Primarily this was the case when analysing English language data sources which constitute the largest dataset. It is evident that users are not necessarily interested in the most trending stories but rather in stories that are relevant to their specific context and their target audiences. Data visualisations that allow users to narrow down to this granular level bring the highest benefit to media organisations.

5 Video Summarisation

During engagement with media professionals at public events and demos and as proved by the results of the Content Wizard evaluation, it became apparent that CERTH's video summarisation service would in particular enable media archives and broadcasters to promote and reuse their audiovisual collections more effectively. As a stand-alone TVP service, it could

be integrated into existing workflows to optimise time-consuming video editing tasks for content publication online, as well as provide mouse-over previews on video content platforms.

While the Content Wizard application provides a user-friendly interface to create video summaries enabling the adjustment of a very limited set of the summarisation process' parameters, advanced users want to maintain more creative control over the content of the video summaries while still benefiting from the automated summarisation process. Such users could benefit from more complex video summarisation profiles tailored for different types of audiovisual content. For instance, a compelling video summary for an evening news programme should not focus only on shots of anchor persons, while a summary for a TV series should showcase the main characters and action-packed shots without revealing major spoilers.

For this reason, NISV decided to carry out additional research to investigate the following three questions:

- How can video summarisation be tailored for **different types of broadcaster content**?
- Which **video summarisation parameters** are relevant for different types of broadcaster content?
- For what **purposes** would professionals use the video summarisation service?
- How do professional users want to use the stand-alone video summarisation service to **benefit from its automation while maintaining creative control**?

To answer these questions, NISV used its extensive collection of broadcaster content to propose **user-defined video summarisation profiles** for various types of content. The following sections describe how these profiles were created and evaluated.

5.1 User-Defined Video Summarisation Profile

As a first step, it was important to investigate whether user-defined profiles could be created for different types of broadcaster content, and if so, how such profiles could be defined. For this reason, NISV decided to focus on a sample of currently popular content types and try to determine summary profiles for them. A list of 18 contemporary programmes from Dutch broadcasters was gathered to showcase a wide range of TV content. This included:

- news programmes
- documentaries
- children's shows
- TV series
- talk shows
- entertainment programmes

From there, a summary for each programme was created using the same parameters (see Listing 1). This created a benchmark for comparing the summaries for different TV programmes. Three members of the NISV team reviewed all the summaries and provided comments about the aspects they liked and disliked, and suggestions for improvement.

```
{
 "video_analysis_sessions": ["session-ID"],
 "lbvs": 1,
 "use_local_repository": 1,
 "target_duration": 30,
 "rhythm": 0.6,
 "auto_render": 1,
 "user_key": "user-key"
}
```

Listing 1: Video Summary call. Here, "lbvs" utilises the learning-based video summarisation method, the length is defined with the "target_duration" parameter at 30 seconds and "rhythm" denotes the pace at which shots change within the summary, with 0 being the slowest and 1 being the fastest. The "use_local_repository" parameter ensures that the video is stored securely on a local server.[11]

All this feedback was reviewed and aggregated to understand what type of programmes require similar parameters. During this procedure, it became evident that since the video summarisation algorithm understands content based on its visual features and structure, it was necessary to use categories that group together visually- and structurally-similar shows. For example, TV series might be very different from sports programming but the main elements that a user would want to see in them are the persons involved, their emotions and key events. To achieve this, seven initial profiles were proposed based on **traditional TV programming genres** (e.g, documentaries) as well as **concept-driven categories** (e.g. studio-based programmes):

- Talks shows and interview-style programmes
- News programmes
- Travel shows
- Studio-based entertainment programmes - including game shows, competitions, performance-centered shows
- Action-based programmes - including TV series, sports
- Documentaries
- Entertainment programmes - including reality shows, children's programming

Following this initial definition, experiments were conducted with different video summarisation parameters for videos in each profile. The intention was to see whether a generic profile could be set up fitting for different types of TV programming in each profile. The following video summarisation parameters were used during the experimentation:

- **White and black concepts** (for details on the respective parameters see "white_concepts" and "black_concepts" bullets in Section 4.7 of D3.2) - are there generic concepts that should be included or excluded for each video in a given profile?

- **Length** (for details on the respective parameter see "target_duration" bullet in Section 4.7 of D3.2) - does a given profile require a shorter or longer video summary to convey the story of the full video?

[11] See D3.2 *Content Adaptation, Re-purposing and Scheduling* for more detailed information on the parameters of the video summarisation calls.

- **Rhythm** (for details on the respective parameter see “rhythm” bullet in Section 4.7 of D3.2) - does a given profile require a more dynamic, faster summary to stay true to its original composition and structure?

- **Range** (for details on the respective parameter see “utilize_story_percent” bullet in Section 4.7 of D3.2) - do certain parts of videos need to be excluded for a given profile (for example, to avoid spoilers or titles at the beginning/end of a video)?

Based on the results of these experiments, the requirements for different types of user-defined profiles were more clearly defined and are presented in Table. 4. Listing 2 presents an example of a call based on one of the profiles using the proposed requirements. To finalise and validate these profiles and their use in operational contexts, media professionals were invited to evaluate them - this process is described in the remaining of this chapter.

User-defined Video Summary Profile	Example Programme	Profile Definition
Talks Shows / Interview-style programmes	Op1, Atlas, Goedemorgen Nederland, Buitenhof	- Summary could be short and quick given that there are not many unique shots in the programmes; - Focus on studio shots; - Avoid any segments in between studio shots.
News	Nieuwsuur	- Do not include filler shots (e.g. stills or landscape shots); - Focus on segments presented in the news, and avoid studio shots of anchor persons; - Try to include more than one shot from each segment.
Travel shows	3 op Reis, Floortje naar het einde van de wereld	- Focus on outdoor shots, cityscapes, landscapes; - Focus on people, food and animals.
Studio-based entertainment	Lingo, 1 tegen 100	- Summary could be short and quick given that there are not many unique shots in such programmes; - Fast tempo to match the energy of such programmes; - Avoid video segments that are used in between studio shots (e.g. when a game show question is illustrated with an archival video)
Action-based programmes	Te land te zee en in de lucht, Spangen	- Avoid filler shots (e.g. landscape shots); - Focus on characters and emotional moments; - Focus on action-driven shots; - Do not include the last minutes of the programme to avoid spoilers.

Documentaries	Tegenlicht, Andere Tijden, Kennis van Nu	- Focus on persons, including close-up shots; - Avoid filler shots (e.g. landscape shots); - Focus on events.
Entertainment	Klokhuis, Boer zoekt vrouw, Heel Holland bakt, Wie is de Mol	- Do not include filler shots (e.g. landscape shots); - Focus on characters and emotional moments; - Focus on events.

Table 4: Description of the proposed user-defined video summary profiles.

```
{
  "video_analysis_sessions": ["URL"],
  "lbvs": 1,
  "use_local_repository": 1,
  "target_duration": 20,
  "rhythm": 0.45,
  "white_concepts":"sin:97,sin:160,sin:186,sin:51,sin:94,sin:265,sin:228,sin:121,sin:71,sin:1",
  "black_concepts":"sin:157,sin:74,sin:243,sin:194",
  "utilize_range":[0.0,0.9],
  "auto_render": 1,
  "user_key": "user-key"
}
```

Listing 2: Video Summary call for studio-based entertainment profile. Here, the white concepts are female_human_face_closeup, male_human_face_closeup, news_studio, cheering, face, surprise, sadness, graphic, crowd, and 3_or_more_people. The black concepts are landscape, daytime_outdoor, sky, and outdoor.

Technical Implementation

To create video summaries from the NISV collection, CERTH's video summarisation service had to be set up locally at NISV. This was a necessary step since the tests were performed with archival content that could only be accessed in a secure environment therefore it could not be sent to CERTH's servers for the video analysis process. In order to set up the Video Summarisation service at NISV, a machine adhering to the requirements for the service was made available to CERTH over a VPN. During the course of a number of weeks, CERTH made adjustments to the service for it to work as a standalone service within a secure network. The service is now fully operational, accessible by devices within the secure network. This implementation will also enable NISV to use the service after the end of the project.

5.2 Evaluation Methodology

Five media professionals evaluated the video summary profiles, one professional from NISV, two representatives from the Dutch broadcasters, and two independent video makers. All users are media professionals with video content creation and editing experience. The evaluation calls with each participant lasted 60-90 minutes. To prepare for the evaluation, NISV created

three summaries for each profile using content from the collection chosen from the example programmes listed in the previous section.

The users were first given an explanation of how video summarisation works and were introduced to the proposed user-defined profiles. Then, they were asked to watch at least one example summary per profile. If time allowed, several per profile were evaluated. NISV used an unstructured interview to gather qualitative feedback and observation, primarily focusing on the following questions:

- Which aspects of the summary did you like?
- Which aspects of the summary you didn't like?
- Did the summary help you understand what the full video is about?
- Do you have any remarks or feedback that could help improve the profile?

Users were encouraged to provide immediate feedback, ask questions and engage in a discussion. The results are described in the following section.

5.3 Evaluation Results

Feedback on the User-defined Profiles

Overall, the feedback on the presented examples of video summaries from the majority of profiles was very positive. In particular, users highlighted the high quality of results for Travel Shows, Studio-based entertainment, Action-based programmes and Entertainment profiles. The detailed comments are provided in Table 5.

User-defined Video Summarisation Profile	Feedback
Talks Shows / Interview-style programmes	- Given that talk shows are dialogue-based, audio is very important hence video summarisation might not be the best approach for creating promotional videos. Instead, video editors would prefer to manually select specific segments based on the dialogue;
News	- All participants reacted very positively to the last shot of one of the summaries that shows a comedic moment (a person falling down while skating), this presents an exciting way to end the video; - The relation between individual shots is not very clear since a news programme covers many topics. One user suggested creating video summaries for individual segments within a news programme to avoid this. Another user did not mind the lack of coherence and instead pointed out that the surprise element would keep viewers more engaged but only as long as the shots offer something exciting (no landscape shots or shots with no action); - A summary for social media should include at least one shot from the studio with the presenter (ideally at the very beginning) so that the viewer can understand what type of programme this is.
Travel shows	- Positive reactions on the focus on landscape shots but still showing enough shots with people;

	- The summary should focus on people talking to each other but avoid shots of people talking directly to the camera; - Positive reaction on the diversity of wide angle, medium and close shots. While landscapes are important for this type of programme, it would not be exciting enough to focus only on them.
Studio-based entertainment	- Summarisation works really well with this type of content as the structure of programmes in this category is usually very clear. One user commented that they would not have suspected that the summary was created not by a human editor; - Clips that have been taken from other programmes should not be included in the summary.
Action-based programmes	- Positive reaction by all users on the inclusion of a shot that contains the title and logo of the show at the very beginning; - Summaries for programmes in this profile work really well as the material is very visual, motion-based, which keeps the viewer engaged; - Positive reaction to the sequence of shots, would need only minor adjustments to construct an engaging narrative that shows the diversity of actions within the full programme.
Documentaries	- Documentaries usually explore a theme, topic or concept rather than a linear narrative which make it difficult to summarise it in a coherent way. It is difficult to draw a connection between individual segments of the summary; - Each documentary is very different, there is no one way to present a narrative, hence each time the summarisation parameters would be different; - One participant did not mind the lack of coherence between individual segments of the video summary and prefered this approach as it provides an element of surprise; - One participant suggested that it might be better to define a specific range for the summary (focus on one particular segment).
Entertainment	- For an example of a food-focused programme, the summary provided a good combination of establishing landscape shots at the beginning and close-up shots of food throughout the video; - The summary should focus on people talking to each other but avoid shots of people talking directly to the camera.

Table 4: User feedback on the examples of user-defined video summary profiles.

When asked about the overall usefulness of the proposed profiles, participants indicated that such profiles would provide a good starting point for their creative workflows, but they would nevertheless like to make manual adjustments in the parameters of the algorithm on a case by case basis. In general, users indicated further editing is needed to improve the quality of the videos returned by each profile. However, this should not be considered as a criticism of the video summarisation service - on the contrary, participants were not expecting to see perfect results and were happy to see that the quality of the automatically generated videos was high enough for them to start making further edits and produce professional-looking videos.

The discussions with participants also highlighted that different user-defined profiles would be necessary for different purposes. For a preview within a media management system, the proposed profiles provide a perfect solution as they provide the viewer with a sense of diversity of shots and narratives within a given programme. It is an easily scalable solution that could be implemented in large-scale archives. On the other hand, to successfully support content creation workflows, a more granular approach is required where video summaries highlight the unique elements specific to each individual video - that could be the persons involved (e.g. celebrities) or the type of prominent visual concepts featured (e.g. food). The proposed profiles could be the starting point for this, but users would need to add additional parameters and possibly generate multiple summaries until they reach a desired result.

Overall Quality of Video Summaries

The evaluation results reveal that the summarisation service performs best on programmes that follow a very **clear structure** (studio-based entertainment), **motion-based content** (sports and shows built around movement) and programmes that rely on **cinematic visual shots** (travel and cooking programmes). Based on the provided video summary examples, participants stated that they would be happy to publish them after performing minor edits (change the ordering of shots or remove certain segments). It is much more difficult, however, to create a compelling summary for a dialogue-based programming (talks shows and comedy), narrative-based programme (documentaries) or shows that contain unexpected segments (sketches in the middle of the programme). For these types of programmes, manual editing would be more beneficial when creating a promotional video to be shared online.

The opinion of participants diverged on the quality of video summaries for programmes that are composed of segments on unrelated topics (news, certain talk shows). Here, some participants stated that the diversity of shots creates an element of surprise which can be exciting, while others argued that the lack of cohesion (which is inevitable when presented a short summary of a larger video) prevents the viewer from understanding what the full video is about. Another point of contention was shots with textual elements, whether as an overlay (encoded subtitles) or as part of the objects in the video (for example, inscriptions on objects, text on paper or digital screens). Some participants argued that such elements provide viewers “a hook”, a reason to watch the full programme and understand what the text was referring to. Others pointed out the text might confuse the viewer if it is taken completely out of context.

All participants except for one indicated that they would see the added value of video summarisation service in their work. They would use it as a starting point in their editing workflows and also they would like to see video summaries when exploring and retrieving content from media asset management systems to get a quick preview of the available content. Everyone agreed that the video summary should not be considered a final product ready for distribution and additional edits would be required, but the automation would significantly reduce the time needed for editing and would allow them to focus on the creative decisions. Ideally, they would like to have the video summarisation service integrated into their professional video editing software. One participant also pointed out that automatically rendered summaries could be a great teaching device to explain video editing basics to students and help them understand the creative decisions that could be taken to make their videos stand out.

The one participant who did not see the need for video summarisation technology in their workflows works primarily with documentaries and specified that a lot of critical thinking and reflection goes into defining the core message for a successful promotional video that would

appeal to its target audiences. This procedure takes into consideration what kind of story is being told in the full video and how it is being told via various oral and visual clues. Instead of detecting objects, algorithms would need to be trained to recognise narratives, structures and cinematic elements in order to fulfil their needs.

Suggested Improvements and Future Considerations

The following list provides general comments from the evaluation that should be taken into consideration to improve the overall quality of video summaries in all profiles:

- Metadata (the title and description of the programme or the persons) could be added as additional parameters to improve video summarisation service. For example, one user suggested that the abstract of the programme could be provided as an input to define the white concepts for a summary. Ideally, users would be able to manually adjust the profiles via a user-friendly interface, similar to the one we built for the Content Wizard application, only with more extensive parameters;
- If any type of text is displayed, the shot should be displayed long enough for the viewer to read it;
- The summary should avoid contrasting colour patterns - it should not jump from very dark to very light shots;
- Shots of people talking directly at the camera should be avoided;
- The introductory shot with the title and graphics of the programme should be included in the summary to enable viewers to quickly understand what the summary is about;
- The summaries could be used in combination with face detection technologies to highlight famous personalities within each programme as they are usually what attract the attention of viewers.

A number of participants hinted at the dangers of biases that algorithms might produce (prioritising caucasian faces, excluding darker shots with non-white persons). No such occurrences were identified in the summaries provided during the testing but it is certainly a very important topic to consider in order to help users trust the results of such algorithms.

One participant pointed out that focusing on emotional moments in the profiles we presented might be detrimental. Strong emotions taken out of context could be interpreted as exploitative at the expense of the portrayed individuals and fail to create a resonating effect with the viewer. Therefore automatic video summarisation would work better for entertainment programmes but careful editorial oversight is needed for content that portrays more serious and difficult topics.

All the above-described input will be taken into consideration during the exploitation phase when implementing the ReTV's video summarisation service in media organisations. CERTH was also notified about this feedback and will take it into consideration when performing improvements on its video summarisation technology. It is evident that there is a lot of potential to collaborate with editing software companies and providers of media asset management systems in order to integrate this service in their solutions. The user-defined profiles presented above could be used as a starting point for such integration and further customisation would be provided based on the needs of each individual organisation and their collections.

6 Discussion and Outlook

The final professional user prototypes and results of their evaluation described in this deliverable present the potential of ReTV technologies for media and content value chains. Specifically, the Content Wizard delivers a range of features that cover the entire workflow for video content selection, adaptation and distribution via online platforms. Topics Compass targets advanced users who want to perform in-depth analysis and monitoring of opportunities for content reuse and performance of their content, and use these data-driven insights to improve their content creation and distribution strategies.

The evaluation results indicate that Content Wizard could provide significant support for organisations who do not have access to professional-grade video creation tools or large teams with specialised expertise in media production and distribution. Equally, the feedback gathered from larger teams shows the potential for using individual features of the tool or possible integration with already existing solutions on the market.

In particular, we identified that the video summarisation service could serve various purposes in media organisation, supporting content creation workflows as well as enabling users to more efficiently review and retrieve content from large-scale collections. Its evaluation highlighted the fact that AI-driven solutions bring most value when they take a supportive role in creative processes.

The period of extensive validation of the prototypes with envisioned end users brought several important insights that will form the basis of future improvements as ReTV transitions from its research phase to executing its post-project exploitation plan:

- Users mentioned various ideas for *new features* to be added. For instance, adding audio editing and community interaction capabilities to Content Wizard, introducing a more granular categorisation of data sources in Topics Compass or adding face detection technologies to highlight famous personalities within video summaries;
- Further insights collected in the evaluation phase will help to *optimise data ingestion* used by the tools, for instance providing a form in the interface of Topics Compass to request new data sources;
- Also, working with media professionals highlighted the need to *provide highly tailorable and modular* solutions. The expectations of the capabilities of tools varied greatly depending on for instance (i) the genre professionals work on, (ii) the frequency of use, and (iii) how the tools fit into the overall workflow.

Next to these overarching insights, the in *situ use* of the Content Wizard prototype over an extended period delivered feedback that will be taken into account in the further development of the tools, and they point to avenues for further research. All these insights and suggestions have already been documented and communicated to the responsible consortium partners (they are summarised in Appendix D).

Appendix A: Example of the Shape Up Methodology Pitch

Title: Storypact Functionality Integration into Content Wizard

Problem (the core idea, motivation behind it)

Storypact and Content Wizard are currently two separate applications. Storypact can support the users of Content Wizard in two ways:

- improve the focus and visibility text created for social media postings by suggesting keywords and entities extracted from related news data, and showing related media items;
- summarise longer texts into messages suitable for publication on social media.

Therefore we need to bring Storypact functionalities into the Content Wizard workflow.

Appetite (how much effort we want to spend on this, what are the priorities)

Combined efforts from weblyzard, Levuro and Genistat. We want a seamless integration that is easy to use, but at the same time, we do not want to create massive changes in the existing Content Wizard interface which would result in delays.

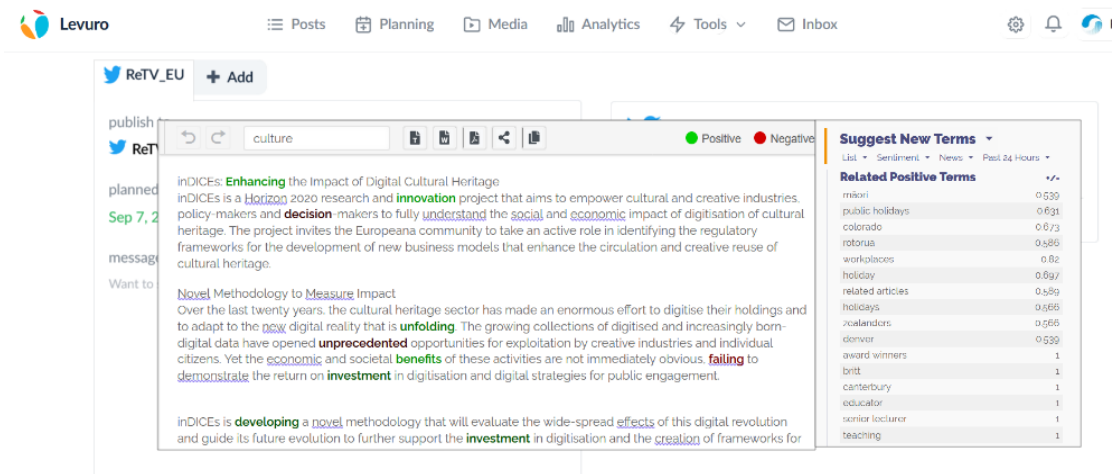
The priority is to have different configurations for different users - RBB needs it in German, while NISV will use it in English. Language could be defined in the API (ideal option), or alternatively, selected in the frontend interface by the user. This configuration needs to be defined between WLT and NISV/RBB.

Solution (description of the proposed solution)

We suggest creating a pop-up window that would open up and provide all the Storypact functionalities. This would work the same way as Grammarly does (see a mock up below):

- the user would click on a Storypact icon in the corner of Content Wizard notepad;
- The Storypact window opens up. If the users had already written any text in the Levuro notepad, this should be automatically copy-pasted into the Storypact notepad. This should happen through the message passing API that we also use in the Planning Page pitch.
- Once the user finishes all the edits and closes the pop-up, the edited text appears in the Levuro notepad. This text is again passed as a message.

Mockup of the Interface:

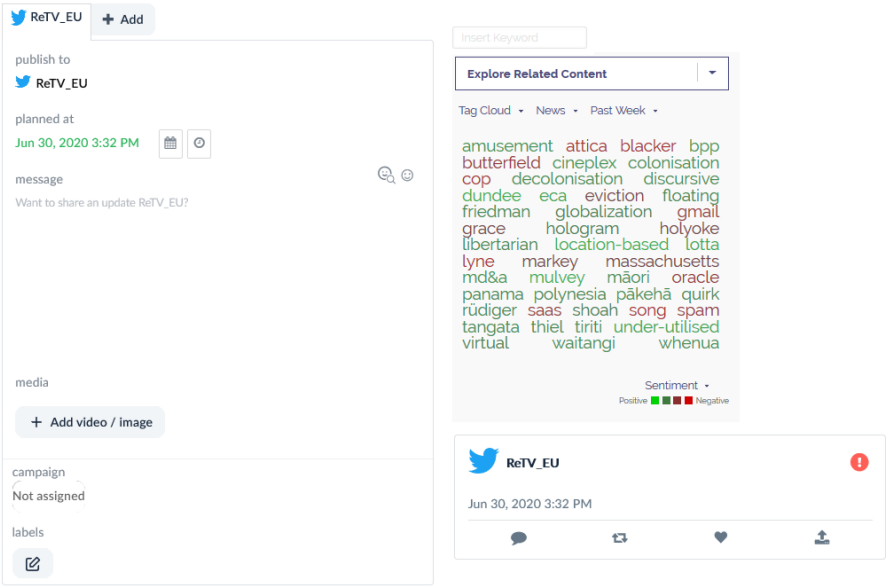


Rabbit holes (problems that might come up, things to consider)

Waiting for API specifications and documentation.

No-gos (things outside the scope of this pitch)

Our original suggestion was to integrate Storypact directly into the Levuro interface so there would be no pop-up window but users could directly use Storypact functionalities in the notepad and see the visualisation on the right side - see a mock up interface below. However, this seems to be a more resource-intensive solution that would require significant changes in Content Wizard therefore it is not feasible within the timeframe.



Appendix B: Evaluation Questionnaires for Content Wizard

Intake Survey

Question	Question type	Possible Answers
What sector do you work in?	Single choice	- Broadcasting - Cultural Heritage
In your daily work, what type of content are you creating?	Multiple choice	- Blogs - Social media posts - News articles/essays - Audiovisual content - Other (please specify)
How many content items do you create per week?	Single choice	- 0-5 - 6-10 - 10-15 - 15-20 - More than 20
Do you use any online tools/services or software (including internally-developed tools) for:	Multiple choice	- Finding topics for content publication - Content publication across social media channels (e.g. Buffer) - Video/sound editing - Text analysis and optimisation (e.g. natural language processing solutions such as Grammarly)
How frequently do you plan new content for publication?	Multiple choice	- Monthly - Weekly - Daily - On an ad hoc basis
What resources do you use for choosing topics for your content publications?	Multiple choice	- News portals - Social media - Online calendars - Other (please specify)
How much time per week (approximately) do you spend on:	Matrix (less than 1 hour, between 1-5 hours, between 6-10 hours, more than 10 hours)	- Findings topic for content publication - Content publication across social media channels - Video/sound editing - Text analysis and

		optimisation (e.g. NLP solutions such as Grammarly)

Weekly Questionnaire

Question	Question type	Possible Answers
Please enter your pseudonym (the same one that you used in the previous survey(s).	Open	
How many times did you use the tool over the last week?	Single choice	- I did not use it this week - Once - 2-3 times - 4-5 times - More than 5 times
How many content items did you create using the tool this week? For example, found a topic for a social media post or a blog, used the recommended publication date feature to select the date for content publication.	Single choice	- None - 1-5 - 6-10 - 11 or more
Which features of the tool did you use this week?	Multiple choice	- Planning Calendar - Trending Stories - Video Search - Video Summarisation - Recommended Publication Date - Text Optimisation
Please rank the features that you used this week according to their usefulness (the most useful at the top, the least useful at the bottom)	Ranking	Selected answers from the previous answer
Were you satisfied with the quality of results provided by each feature of the tool in your workflows this week? For example, were the calendar events relevant? Were the recommended publication dates accurate? If you did not have access to the	MATRIX: Very unsatisfied, unsatisfied, neutral, satisfied, very satisfied, not applicable	- Planning Calendar - Trending Stories - Video Search - Video Summarisation - Recommended Publication Date - Text Optimisation

feature, select Not Applicable.		
Do you have any general comments/feedback?	Open	

FINAL SURVEY

Question	Question type	Possible Answers
Your Workflow		
On a scale from 1 to 5, rate your overall experience with the Content Wizard application.	Scale from 1 to 5	
How useful is each feature of Content Wizard for your workflows, NOT taking into account the quality of the results returned by them?	Scale from 1 to 5	- Planning Calendar - Trending Stories - Video Search - Video Summarisation - Recommended Publication Date - Text Optimisation
Based on your experience with the tool, please evaluate the following statements about the impact of the tool on your workflows, NOT taking into account the quality of the results returned by the individual features:	MATRIX: Strongly disagree, disagree neutral, agree, strongly agree, not applicable	- The tool would help me save time on topic selection for content publications. - The tool would help me save time on video editing. - The tool would help me to (re)publish more audiovisual content online. - The tool would help me save time on text creation. - The tool would help me carry out my daily tasks. - The tool would help me plan content publication in advance.
How would you use the tool in the future?	Single Choice	- As the main application to support the whole content creation, editing and publication workflow. - As the main application for the content creation, editing and publication workflow, but I would also use some additional tools (for example, professional video editing software). - I would only like to use certain functionalities of the tool in my

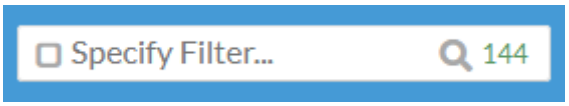
		already existing workflow. - I would not use it, the tool does not provide me with the functionalities I need.
What did you like the most about the tool?	Open	
What did you like the least about the tool?	Open	
Usability		
Please evaluate the following statements about the usability of the tool:	MATRIX: Strongly disagree, disagree neutral, agree, strongly agree	- I would like to use this tool in my daily workflows. - I found the tool too complex. - I thought the tool was easy to use. - I would need the support of a technical person to be able to use the tool. - I found the various features of the tool were well integrated to support my workflows. - I thought there was too much inconsistency in this system. - I would imagine that most people would learn to use this system very quickly. - I found the system very cumbersome to use. - I felt confident using the system. - I needed to learn a lot of things before I could get going with this system. - It is useful to have all functionalities for content creation, editing and publication in one tool.
Please add three adjectives that describe your overall experience with the tool	Open	
Quality of the Results		
On a scale from 1 to 5, please rate the quality of results provided by each feature of Content Wizard.	Scale from 1 to 5	- Planning Calendar - Trending Stories - Video Search - Video Summarisation

		- Recommended Publication Date - Text Optimisation
Please evaluate the following statements:	MATRIX: Strongly disagree, disagree neutral, agree, strongly agree	- Using the Planning Calendar, I was able to find topics for content publication. - Using the Trending Stories feature, I was able to identify opportunities to publish content. - Using the Text Optimisation feature, I was able to summarise longer texts into messages that I could post on social media. - Using the Text Optimisation feature, I was able to find keywords to improve the focus of my texts.
Did you use the video search and video summarisation features?	Single Choice	Yes - if YES, show the next question No - if NO, skip the next question
Please evaluate the following statements:	MATRIX: Strongly disagree, disagree neutral, agree, strongly agree	- Video search results helped me discover more diverse content from the media collection. - I found that the generated video summaries accurately represented the content of the full videos. - I found the video summarisation templates for different social media platforms useful. - I found it useful to adjust the length, range and cut frequency of video summaries. - I needed to edit the structure of video summaries until I was happy with the outcomes (for example, delete certain shots).
Final Observations		
Did you miss any functionalities?	Open	
Do you have any other comments or suggestions?	Open	

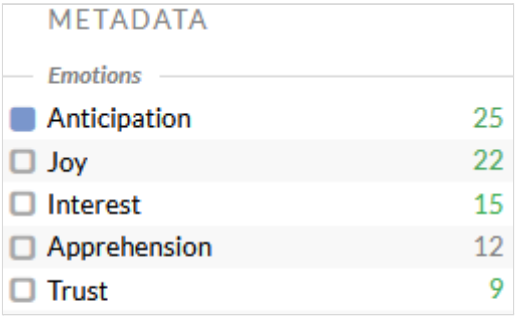
Appendix C: Example Scenario of Using Topics Compass

Goal: find ideas for content publication for 15-28 February.

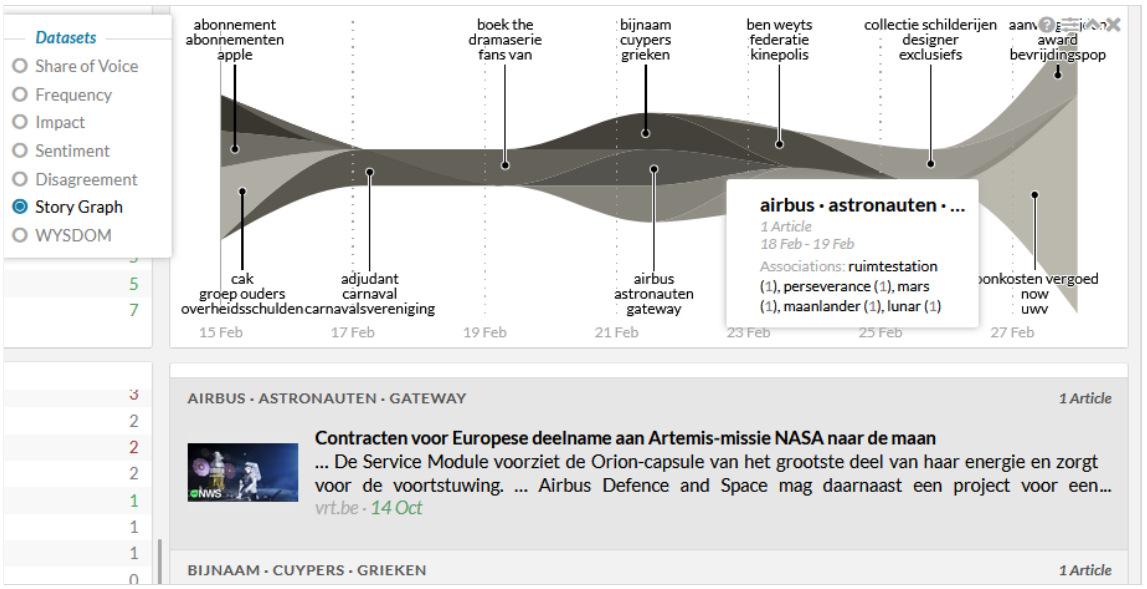
1. Activate **Extracted Events** in Configuration to switch to prediction mode.
2. Use the **Date Range** to narrow down search results to 15-28 February.
3. To see all the data sources that mentions these days, go to the **search bar** and enter "*" or just press enter. We get 144 search results. Click on the rectangular market in the search bar to visualise those results.



4. We decide to focus on stories associated with positive news and excitement. To do so, we will use the analysis of **Emotions** in the **Metadata** section (bottom left). We click the rectangular market next to Anticipation which visualises 25 data sources in the dashboard.

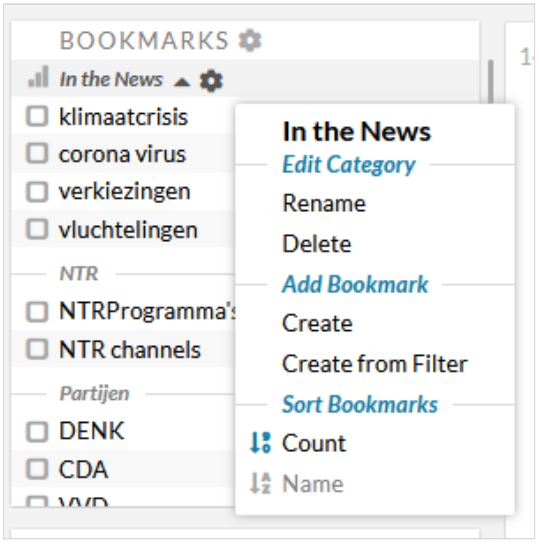


5. We switch to **Story View** in the Trend Chart to analyse this data. Here we find an interesting article related to Mars Rover landing expected on 18 February.

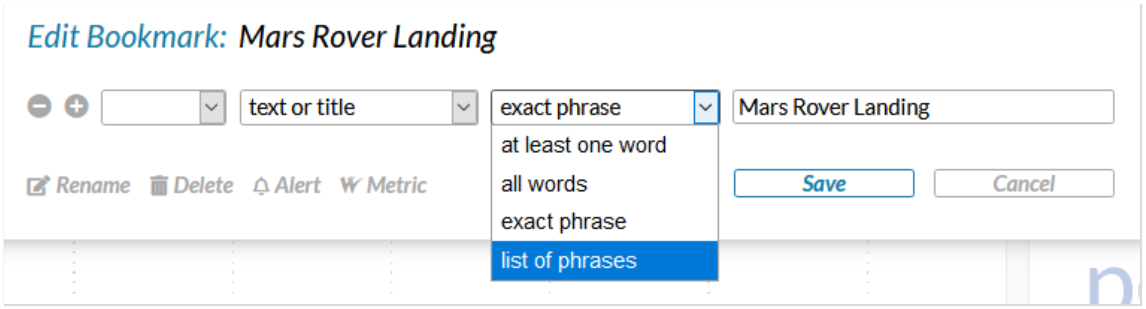


6. We could use this event as an opportunity to create new content about the Mars Mission or republish related articles and footage from the archive.

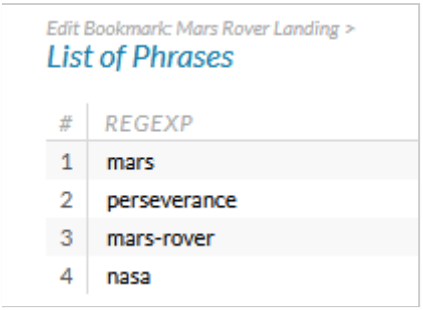
To make sure that we can monitor the latest news about the mission, we create a **new bookmark**. To do so, hover over the title of one of the bookmark categories (for example, *In the News*) and click on the settings icon . Select *Create* under *Add Bookmark*.



Enter your preferred title. To **customise the bookmark**, hover over it and click on the settings icon next to it. A new tab will open. From the dropdown menu, choose to add a *list of phrases*.



Enter the keywords that you would like to monitor. Make sure to use terms that are specific enough to get the most accurate results.



If you do not know what keywords would be relevant, go back to the search results and look through the list of Associations or the Tag Cloud for inspiration. You could also extend the search results to include Data Sources from other languages to see what keywords are used there to report on the story.

Appendix D: Suggestions for Further Improvements

User Application	Related Feature	Request
Content Wizard	**Planning Calendar**	Make the event filters more prominent on the left side of the interface. Use colour coding for different filters.
Content Wizard	**Planning Calendar**	Allow users to assign a task to an event (e.g. connect the event to an already scheduled message)
Content Wizard	**Planning Calendar**	Allow users to remove irrelevant events. The tool could also monitor which events users select and which they remove in order to provide more accurate suggestions.
Content Wizard	**Trending Stories**	Allows users to edit the bookmarks.
Content Wizard	**Video Search**	The current search works well with object-oriented queries, but not with proper names. We propose to experiment with a hybrid search approach - combine text-to-video search with search over metadata.
Content Wizard	**Video Search**	Allow users to edit the search query and add additional keywords.
Content Wizard	**Video Summarisation**	Integrate CERTH's smart cropping service.
Content Wizard	**Video Summarisation**	Allow users to create a summary that takes into account the topic selected from the Planning Calendar or Trending Stories. For example, if the user is creating a video about Easter, then the summary should prioritise shots related to Easter in the summary.
Content Wizard	**Video Summarisation**	Allow users to create a summary from multiple videos.
Content Wizard	**Recommended Publication Time**	Display data sources related to the suggested date to allow users to understand why a given day was recommended to them.
Topics Compass	**Data Sources**	Allow for a theme-based categorisation of data sources (e.g. categories such as culture, technology, sports, politics, etc.).
Topics Compass	**Data Sources**	Allow users to add their own data sources via the Topics Compass interface.
Topics Compass	**Data Sources**	Separate tweets from retweets.

Topics Compass	**Prediction Mode**	Sort documents by prediction date.
Topics Compass	**Metadata analysis**	Analyse hashtags and tags in social media as separate from the rest of the content (i.e. identify terms with the # symbol)
Video Summarisation	**n/a**	Extracts entities from video titles and abstracts in order to define the focus of a video summary. This should be highly configurable (i.e. the user should be able to adjust the entities used).
Video Summarisation	**n/a**	Combine the video summarisation service with face recognition technologies in order to include famous personalities into summarised videos.
Video Summarisation	**n/a**	Train algorithms to detect colour schemes in order to avoid high contrasts between shots in the video summary.
Video Summarisation	**n/a**	Introduce a parameter that includes the opening shot with the title or logo of the programme as an opening shot.
Video Summarisation	**n/a**	Identify shots within the generated summary that contain text and automatically assign an optimal length for them to ensure that viewers have enough time to read the text.