



## A.I.-assisted automation of Subtitling and Localisation – Lessons Learned

*(Contact: [maarten.verwaest@limecraft.com](mailto:maarten.verwaest@limecraft.com))*



Co-funded by the  
Creative Europe Programme  
of the European Union

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connected creativity

## 000. About Limecraft

### Limecraft

- Incorporated May 2010
- Professional Video Production (High-end episodic, non-scripted, Archiving)
- Customers : producers, post facilities and broadcasters

### An intelligent approach to Media Asset Management

- In the cloud if possible, local when necessary
- Harnessing AI for Ingest, logging, rough-cut,...
- Turn-key workflows for fiction, non-fiction, subtitling and localisation

### Stay updated

- [www.limecraft.com](http://www.limecraft.com)
- [facebook.com/Limecraft.connected](https://facebook.com/Limecraft.connected)
- [twitter.com/limecraft](https://twitter.com/limecraft)





In: library

search 74 results

SCENE 1 | 3 takes in 1 shot

Shot 1.1 | 3 takes

1.1.1 | P1080168.MOV 00:01:13:11 20/07/2015 P  
1.1.3 | P1080172.MOV 00:00:50:10 20/07/2015 P  
1.1.2 | P1080169.MOV 00:00:05:07 20/07/2015 P

SCENE 2 | 10 takes in 3 shots

Shot 2.1 | 4 takes

2.1.1 | P1080159.MOV 00:01:01:11 19/07/2015 P  
2.1.4 | P1080157.MOV 00:00:25:11 19/07/2015 P  
2.1.3 | P1080158.MOV 00:00:27:09 19/07/2015 P  
2.1.2 | P1080161.MOV 00:01:09:15 19/07/2015 P

Shot 2.2 | 4 takes

channel4.jpg 00:00:00:00  
channel4.jpg 00:00:00:00  
channel4.jpg 00:00:00:00  
channel4.jpg 00:00:00:00

# Limecraft Flow

## Limecraft Flow

- Media Asset Management
- Automated workflow processing
- Configurable dashboard

## Turn-key Workflows

- Automatically cuts Shots into Scenes
- Machine Transcription
- Auto-subtitling

## Key Benefits

- Avoid human errors
- Cuts 30% of the post-production cost
- Faster turn around

**Rebranding**

**Simple and advanced search**

**Export of selection**

**Actions executable on a single clip or a selection of clips**

**Configurable collection structures and thesauri**

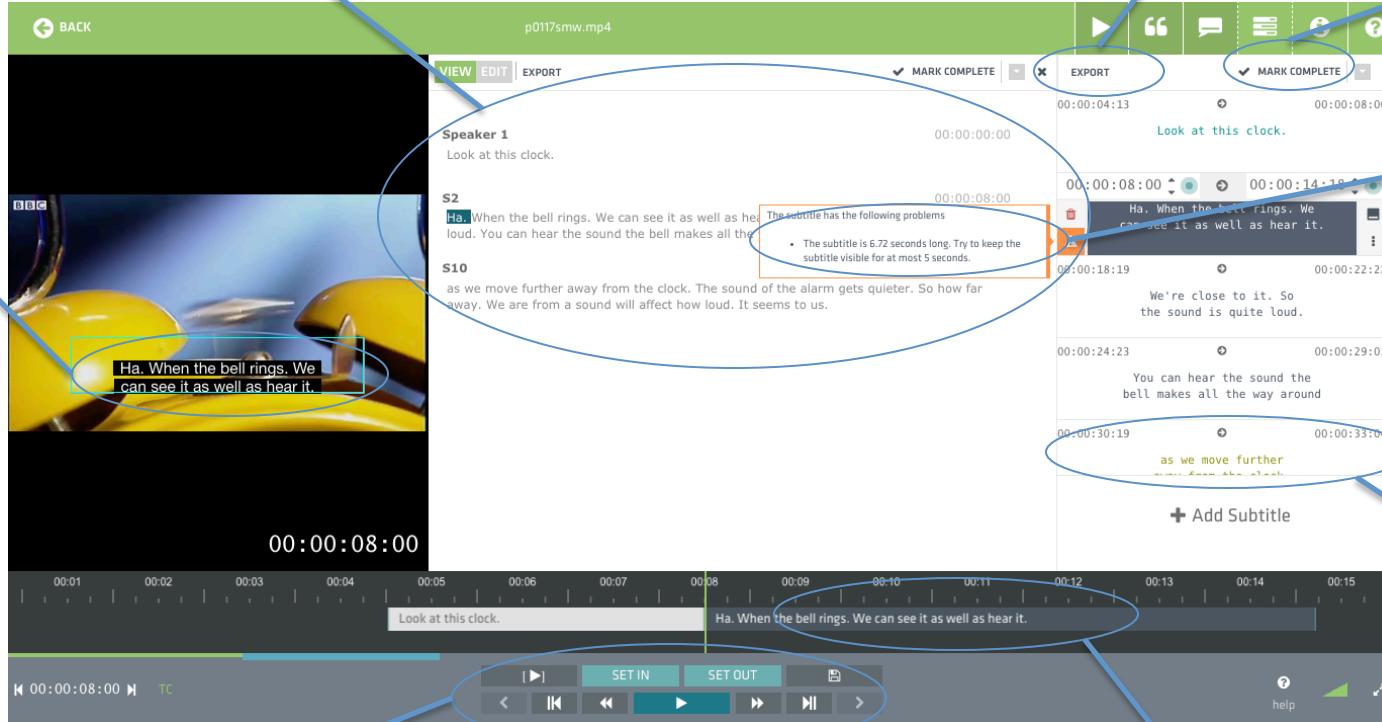
**“Smart” Collections to control the workflow**

**Configurable import and export workflows**

Take advantage of Machine Transcription  
to accelerate the workflow

Export of SRT, STL, EBU-TT

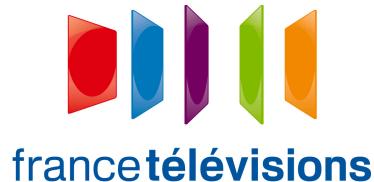
What you see  
is what you get



Professional player with controls  
For fast/slow/reverse playback

Modify the timing  
by dragging and dropping on the  
timeline

Different  
colors per  
speaker



nederlandse  
publieke  
omroep



OPTIONMEDIA  
WE MANAGE MEDIA.



- How can we take advantage of A.I. tools that are available today?
  - How to select the right subset of information from the deluge of metadata generated by A.I. analytics?
  - How to deal with inaccuracies of the A.I. analytics?
  - How do we make the functionality of these A.I. tools easily available to production people?

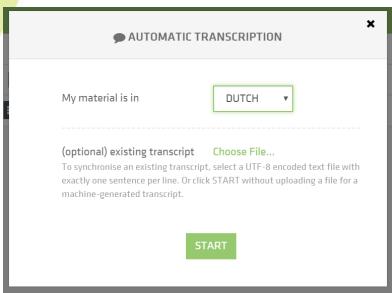
## Use Cases

1. Metadata enrichment for cataloguing and better retrieval
2. A.I.-based methods for accessibility purposes
3. A.I.-based methods for localisation



## Metadata enrichment for cataloguing and better material retrieval

-> Provide centralized and structured logging and transcription of material



- By means of full machine transcription (ASR) using optional manual corrections, or import an existing transcript and align with audio.
  
- Logging using the transcript
  - Get timecodes using text selection
  - Add remarks
  - Select material
  - Send to editing

A screenshot of a video editing application's interface. At the top, it says "May 22nd" and "In: subtitling/Karel - completed". A search bar shows "patagonia" with "1 result". Below the search bar is a video preview window showing two people. To the right of the video is a timeline with a blue marker at 00:00:30:17. Below the video, under "SELECTED EXAMPLES", it says "2 matching subclips between 00:00:30:17 and 00:00:59:17." One example is shown with the timestamp "dieter - 6/5/2018, 10:32:40 AM" and the duration "00:00:30:17 - 00:00:54:07". A quote from Yvon Chouinard is displayed: "My name is Yvon Chouinard. I'm the founder of Patagonia. I met Royal at Stony Point in the San Fernando Valley." The quote ends with "Yvon Chou...". At the bottom right, there is a note: "Another interesting quote."

# Royal Robbins

## America's first iconic climber

00:00:30:17

**DEMO**

## EXPORT

## ✓ COMPLETED

## EXPORT

## ✓ MARK COMPLETE

**Music** (music) 00:00:01:05

**Alex Honnold** 00:00:07:10  
I'm Alex Honnold, and I think Royal Robbins is the man.

**Yvon Chouinard** 00:00:12:12  
We used to call him the Icy Commander

**Conrad** 00:00:18:22  
All of us who are in the sport today that make their living from it. We have a sense of gratitude to Royal for showing us the way.

**Yvon Chouinard** 00:00:30:17  
*My name is Yvon Chouinard. I'm the founder of Patagonia. I met Royal at Stony Point in the San Fernando Valley, where we kind off all learned to climb. We were lucky to be part of the golden age of Yosemite climbing. In 1964, Royal asked me to come along on the first ascent of the North American wall, El Capitan. You know, I had always told my parents that I was a climber, but they didn't know what that meant.* Then one day looking at television on the nightly news, there was a helicopter going by the North American wall, and El Cap, and they zoom in on these crazy guys hanging from hammocks. My parents just about fell off the sofa. First time in their lives, they realise what climbing really meant.

When we did it was really the most ?? rock-climb that had been done anywhere. It was his idea to do that climb and he was definitely the leader.

**Alex Honnold** 00:01:40:17  
I'm Alex Honnold, I'm a professional climber and I think Royal Robbins is the man. I think Royal's legacy probably is clearest in climbing, in contradiction to the clean climbing ethic where the challenge was more intellectual, in like, learning the gear, less about, overcoming the mountain and more about, verifying yourself and being able to challenge yourself on the inside. I'd heard from his family, and some of his friends, that he thought highly of muscle and stuff. And I can see why, because it's sort of in the same spirit as, what he was doing. It's pretty exciting to think that Royal Robbins, for like knows who I am, slash, like has an opinion on my climbing. It's pretty cool.

**Voice-Over** 00:02:40:24  
Some ?? choose a life in i.t. or event planning. Conrad Anker has opted to swing from a nylon stanchion 19,000 feet up a cliff. It may seem an odd way to spend one's life, but it's his

search 3 results |

6/5/2018, 10:32:40 AM 23.6s dieter

00:00:30:17 00:00:59:17  
My name is Yvon Chouinard. I'm the founder of Patagonia. I met Royal at Stony Point in the San Fernando Valley, where we kind off all learned to climb. We were lucky to be part of the golden age of Yosemite climbing. In 1964, Royal asked me to come along on the first ascent of the North American wall, El Capitan. You know, I had always told my parents that I was a climber, but they didn't know what that meant.

– Yvon Chouinard

#interesting\_quote

1/14/2018, 4:54:20 PM 29s dieter

00:03:27:22 00:03:35:15

I mean Royal was a classic American boy, there is no doubt about it. It's kind of, kind of a square. Yeah, he'd marry early and he had a wife.

– Yvon Chouinard

more quotes.

6/5/2018, 10:50:22 AM 7.7s dieter

+ Add Subclip



## #1 - Metadata enrichment for better material retrieval and cataloguing

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  "structuredDescription": {  
    "confidence": null,  
    "parts": [  
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        "word": "I'm ",  
        "channel": 1,  
        "speaker": "Male 4",  
        "type": "LEX"  
      },  
      {  
        "start": 189,  
        "duration": 6,  
        "confidence": 0.969,  
        "word": "Alex ",  
        "channel": 1,  
        "speaker": "Male 4",  
        "type": "LEX"  
      },  
      {  
        "start": 195,  
        "duration": 6,  
        "confidence": 0.58,  
        "word": "Donald ",  
        "channel": 1,  
        "speaker": "Male 4",  
        "type": "LEX"  
      },  
      {  
        "start": 208,  
        "duration": 2,  
        "confidence": 0.636,  
        "word": "and ",  
        "channel": 1,  
        "speaker": "Male 4",  
        "type": "LEX"  
      }  
    ]  
  }
```

## Integration of Machine Transcription in Limecraft Flow

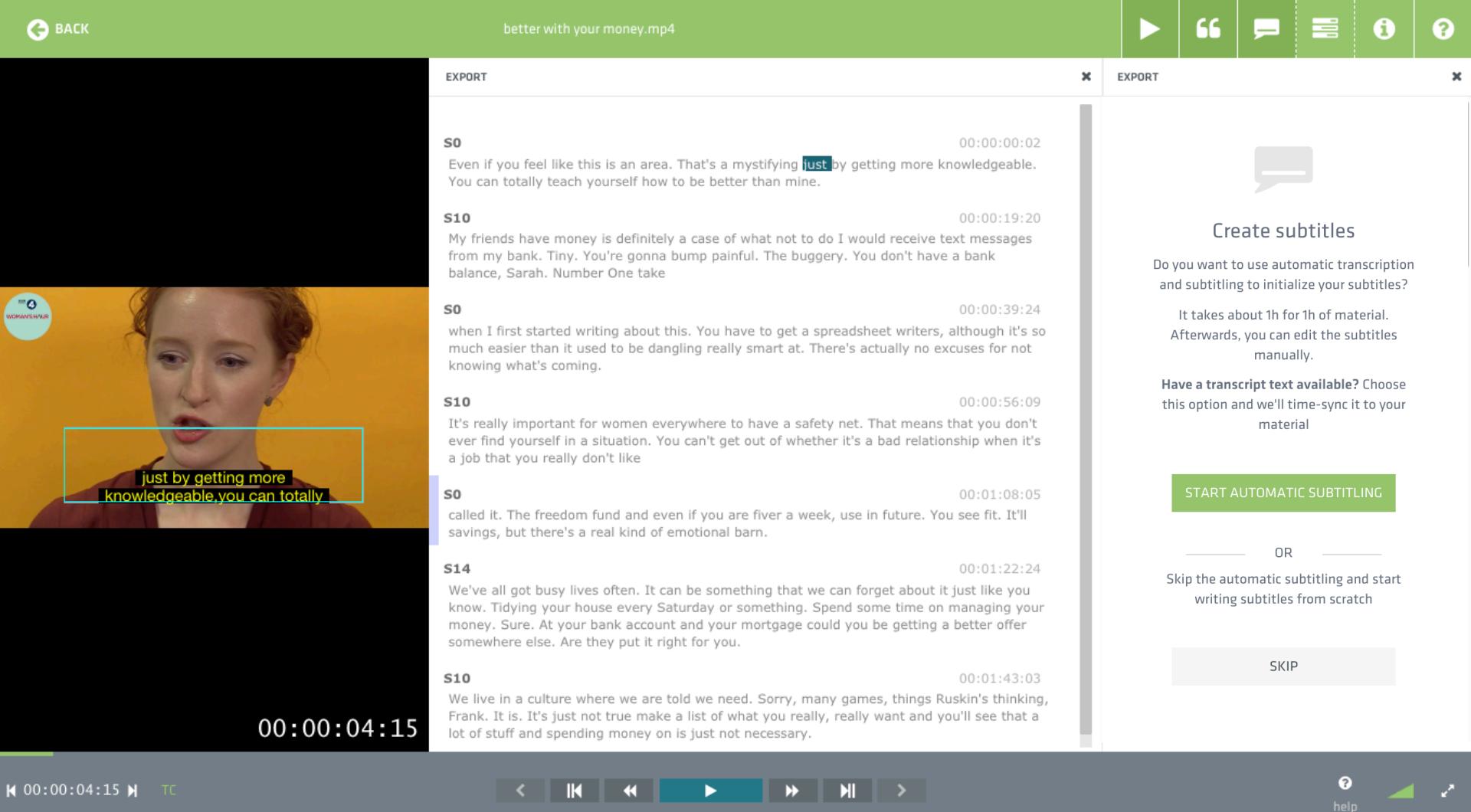
- Transcript output contains timings per detected word
  - We store confidence scores. This might help users in the future to perform corrections or quickly detect sections in which the transcription is worse than in others.
- ASR provides speaker segmentation and/or identification
- Best of Breed (incl. Google Speech API, Kaldi, ...) and consolidate individual formats into a unified transcription format.
  - Depending on the best expected result, we mix and match ASR engines per production and per language.
  - Or even need to fall back to manual transcription for certain types of content (e.g., children's interviews)



## Auto-transcription is the basis for automatically generated subtitles

- Journalists, content producers who typically have no easy direct access or budget to subtitling
- Provide convenient tooling that is miles away from manual title creation in edit suites
- Move towards a widely adopted solution for organization-wide support for subtitling, including broadcaster and production companies
- Deliver subtitles in a variety of formats, including EBU-TT-D, SRT, STL, etc.





## Generating subtitles is a bit of A.I. of itself

- Spotting rules have been encoded into the algorithm
  - Best score wins, but might violate some constraints
- Use the detected shot cut boundaries for subtitle alignment

**WORKFLOWS**

✓ Ingest

- Detect Type       03s
- Transcode to mp4 (SD)       02m09s
- Analyze media       01s
- Extract features       06m01s
- Analyzing audio waveform       0s
- Transcode to mp4 (720p)       03m55s

✓ Automatic Transcription

- Transcode       04s
- Automatic transcription       01m26s
- Generate Subtitles       48s

✓ Subtitles From Transcript

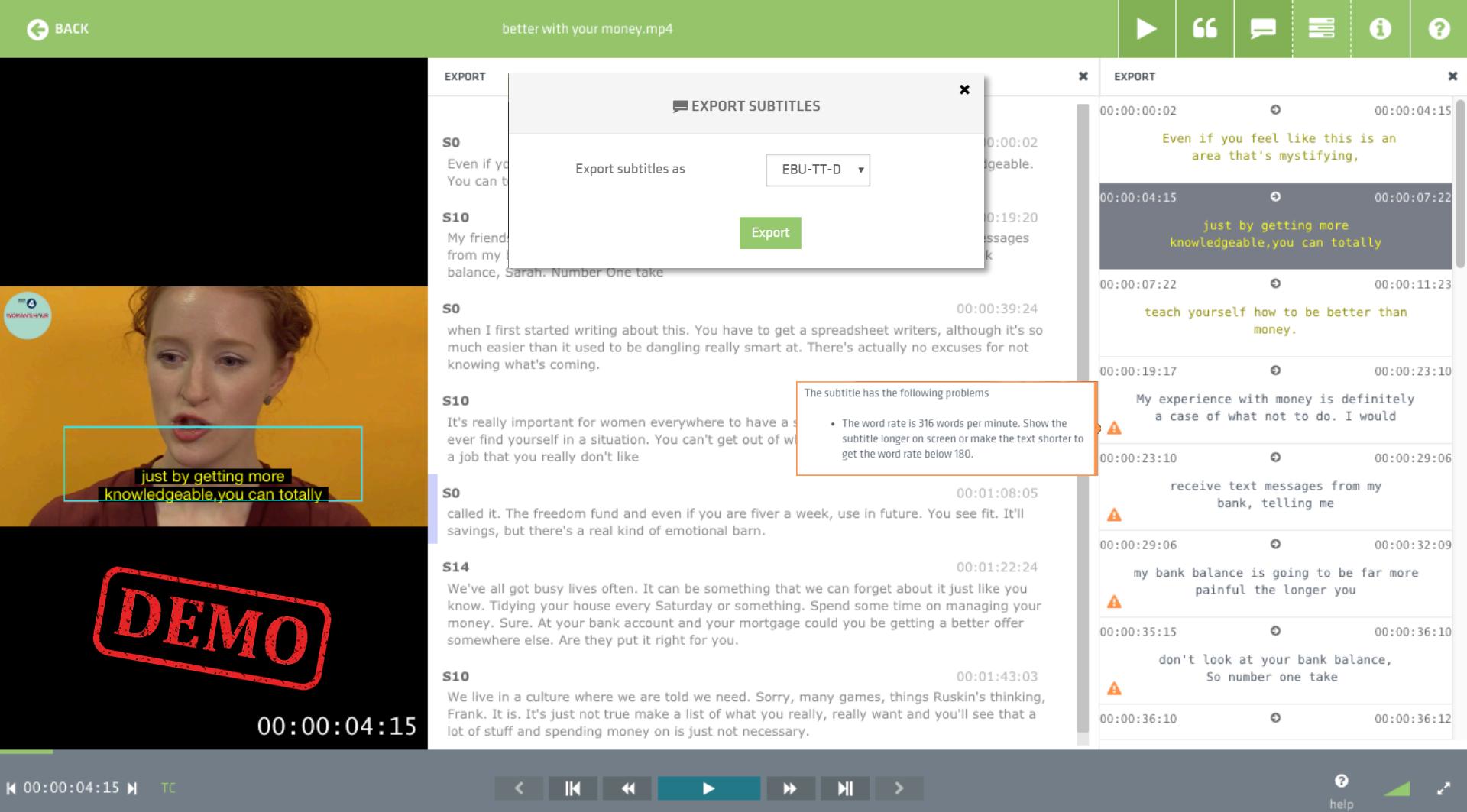
- Generate Subtitles       53s

### Automatic Subtitler Spotting Rules

Tweak the behaviour of the automatic subtitler.

- A subtitle line preferably contains at most  characters, with a hard limit of  characters
- A subtitle preferably contains at most  lines, with a hard limit of  lines
- Keep the word rate below  words per minute
- When the gap between consecutive subtitles is less than  seconds, the first subtitle will be shown until the start of the next subtitle
- Snap the subtitle appearance timing to the shot change if it is closer than  seconds
- Fade out for  seconds after the last spoken word in the subtitle
- A subtitle preferably is between  and  seconds
- Prevent splitting these words from the next word (one word per line)

```
a
the
to
and
be
...
```





## One step further - machine translation for Localisation

- Translated subtitles serve a different purpose
  - Translated subtitles makes non-domestic content accessible to new audiences
  - No need for colours and annotations
- Prototype development supported by Creative Europe “Subtitlebot” project (1/1/2018 – 31/1/2019)

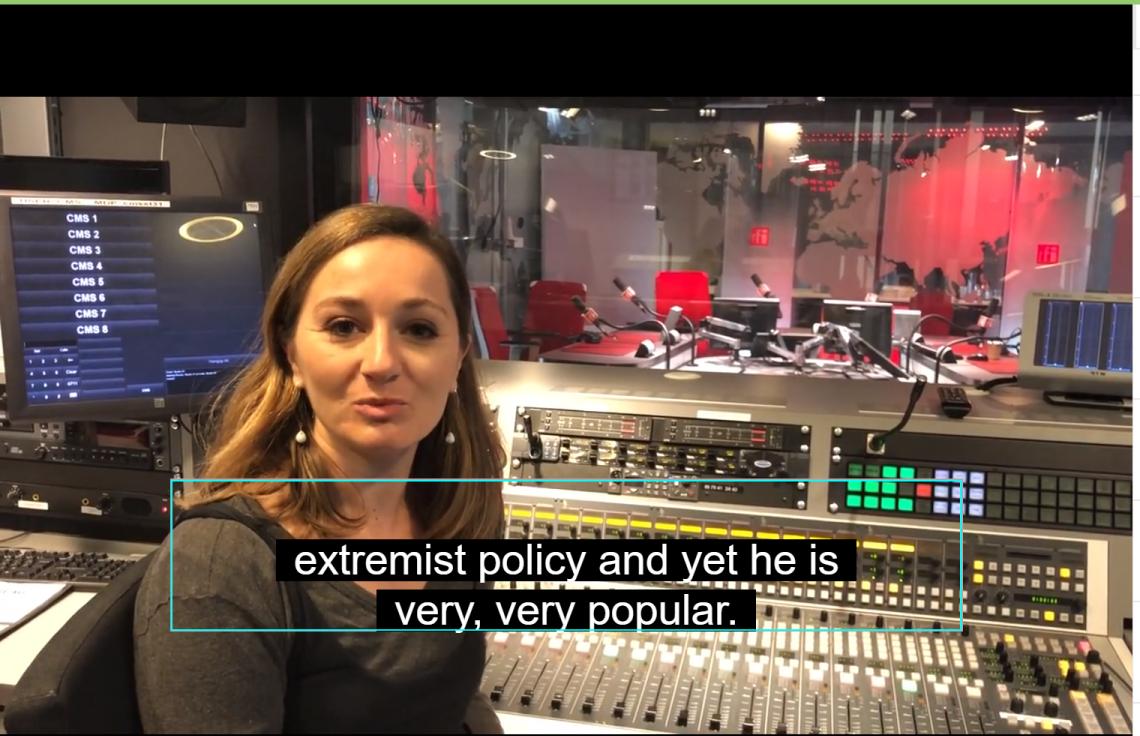


CALL FOR PROPOSALS – CNECT 2017/3135124

Action on subtitling including crowdsourcing  
to increase the circulation of European works



Co-funded by the  
Creative Europe Programme  
of the European Union



00:00:07:19

Hello tonight in Decryption I take you to ... more about the Duterte method. The Philippine president ...  
Bonjour ce soir dans Décryptage je vous e... pour mieux connaître la méthode Duterte. Le président phil...  
extremist policy and yet he is very, very popular.  
une politique assez extrémiste et pourtant il est ...  
So our guest will help us understand why. And i...  
Donc notre invité va nous aider à comprendre p...  
aussi vous avez des questio...

TRANSLATED FROM: fr

LANGUAGE: en

	EXPORT	MARK COMPLETE	
	00:00:00:22	00:00:03:19	Hello tonight in Decryption I take you to the Philippines to learn ⚠
	00:00:03:19	00:00:07:19	more about the Duterte method. The Philippine president has a rather
	00:00:07:19	00:00:11:01	extremist policy and yet he is very, very popular.
	00:00:11:01	00:00:14:10	So our guest will help us understand why And if you have any ⚠
	00:00:14:10	00:00:18:09	questions about Rodrigo Duterte and his feel free to submit them ⚠
	00:00:14:10	00:00:21:14	to us in the show's Facebook and Twitter page. We choose some ⚠
	00:00:21:14	00:00:24:21	of them, we ask them to our guest. So it's at 7:10 ⚠

DEMO

## Currently available in beta:

- New processing pipeline with
  - Subtitle processing dependent on chosen use case
  - Machine-learning-based translation services
  - NLP post-processing for optimizations for sentence/subtitle splitting.
- Extended Flow with support for different languages of subtitles and transcripts
- Dutch, English, French, Spanish, German, Italian, Polish, Portuguese, Russian

Available in beta now, we appreciate your feedback!

- Spotting rules should be optimised and configured per language for better presentation
- Optimise trade-off between length of the translation context vs. accuracy of the translation and timing.
- Take a free try: <https://platform.limecraft.com/#auth/signup>





## Conclusions

- We're bringing A.I. technologies to the production environment in a way that adds value for end users
- Works great in a couple of cases
  - Transcription
  - Same-language subtitling for accessibility purposes
  - Translated subtitles for localisation purposes
- Saves > 50% of the cost and the turn around time
- Stay in touch and don't forget to register for a free try!

