

# A Synchronisation Mechanism based on User Feedback for Second Screen Applications

Pedro Centieiro<sup>1,2</sup>, Teresa Romão<sup>1</sup>, A. Eduardo Dias<sup>1,2</sup>, Rui Neves Madeira<sup>1,3</sup>

<sup>1</sup> NOVA-LINCS, DI, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa  
2829-516 Caparica, Portugal  
pcentieiro@gmail.com,  
tir@fct.unl.pt

<sup>2</sup> Viva Superstars Digital Media Lda, Madan Parque, Rua dos Inventores  
2825-182 Caparica, Portugal  
edias@bviva.com

<sup>3</sup> ESTSetúbal, Instituto Politécnico de Setúbal  
Campus do IPS  
Estefanilha, Setúbal, Portugal  
rui.madeira@estsetubal.ips.pt

## ABSTRACT

In this paper, we present an interaction mechanism that allows TV viewers to synchronise their second screen applications in a simple and effortless way. This mechanism relies on the user feedback to deliver in-sync second screen events, and was designed as a universal solution that can be used on any live broadcast.

## Categories and Subject Descriptors

H.5.2 [User Interfaces]: Input devices and strategies, prototyping.

## General Terms

Design, Experimentation, Human Factors.

## Keywords

Second screen, delays, synchronisation, live TV broadcasts, HCI, user experience, sports fans, soccer.

## 1. INTRODUCTION

It is undeniable that TV viewers are used to interact with additional technological devices while watching television. A survey conducted by Nielsen in the first quarter of 2013 [1] shows that nearly half of smartphone (46%) and tablet (43%) owners use their devices as second screens while watching TV every day. Therefore, there has been a high interest in exploring the second screen concept (e.g. [2, 3]).

However, since different TV providers have distinct types of connections and hardware, viewers often receive events on second screen applications, which are not synchronised with the TV broadcasts. Nonetheless, it is possible to solve this issue in two ways, without having to add or replace hardware: by using inter-destination media synchronisation (IDMS) to synchronise all the viewer's televisions; or by using automatic content recognition (ACR) on the TV broadcast audio to synchronise each viewer's

mobile application. The goal of IDMS is to deliver the same stream for all the individuals of a group at the same time. Nevertheless, viewers are dependent on the TV service providers to implement this solution, and if they do not do it then the synchronisation problem will remain. Regarding ACR, there are two main methods to identify a given TV show: audio watermarking and audio fingerprinting. Audio watermarking works by adding a well-defined sound to an audio stream, in order to be detected by an algorithm. Audio fingerprinting works by comparing an audio fragment to a database of unique audio fingerprints of millions of audio files. However, there are not enough third-party APIs for ACR that can detect any given TV show, resulting in most viewers around the world not being able to synchronise their applications with the TV broadcasts.

These facts motivated us to implement a universal and simple, yet powerful, interaction mechanism that easily allows users to synchronise their second screen applications with TV broadcasts. This interaction mechanism is named Synchronisation Mechanism through User Feedback (SMUF) and is based on the feedback provided by users on how the applications' events are synchronised with the corresponding TV broadcasts. We developed a prototype called WeSync to evaluate how users interact with SMUF and to analyse if users are able to effectively synchronise a second screen application with a TV broadcast.

## 2. WESYNC

WeSync is a mobile application that prompts users to guess the outcome of corner kicks, penalty kicks and free kicks during a soccer match. Users can also check their friends' predictions and scores. Furthermore, WeSync also notifies users when a goal is scored (allowing them to quickly share their thoughts on social networks), or when a half starts or ends. However, these events are not synchronised with the TV broadcast, and thus, users need to synchronise it by using SMUF, which can be done by adjusting a slider after each event occurrence (Figure 1). Through SMUF, users can rate their experience, providing feedback on how the application is presenting the events. Each subsequent event is presented taking into account the previous user feedback, in order to iteratively achieve an adequate synchronisation between the application and the TV. This mechanism is also suitable for other sports, TV shows, or e-Sports.

An interaction walkthrough is presented below in order to give a better perception on how SMUF works on WeSync:

- 1) After the users complete a given interaction, like predicting the outcome of a corner kick, a screen appears asking them to rate their experience.

- 2) Users may specify that the application is synchronised by simply clicking on the “Confirm” button, or they can adjust the slider in order to select how the application behaved compared to the television.
- 3) If the user starts to adjust the slider, a text appears describing the experience rating currently selected (e.g. “Good! App is 1.5 seconds ahead.”), and showing the delay being set by the user (in seconds). Moreover, the slider changes its colour (e.g. red indicates a higher delay) and an animation starts on the upper half of the screen indicating how that given delay corresponds to the user’s experience. Users with a high broadcast delay can move the slider all the way to the right (maximum is 4s) and once there, if they keep their fingers on the slider, its scale will increase to allow for a higher maximum value (4s are added to the maximum value every 0.5s a finger is kept on the slider). Once users are pleased, they can touch the “Confirm” button.
- 4) The next time a key event happens, the application will delay the request by the number of seconds cumulatively chosen by the user, so it can be closer to the TV broadcast timeline. After the user finishes interacting with the key event, a screen will appear once again asking for his feedback (Figure 1a). At this time, users can move the slider to the left, decreasing the delay that was previously set (they can also keep their finger on the slider to increase the minimum value). Users can also move it further into the right (Figure 1b), increasing the delay even more, again up to a maximum of 4s. This process will repeat until the user confirms that the application is synchronised or close to being synchronised (delay < 1s) with the TV.
- 5) Once users state that the application is synchronised, the application stops asking them about their experience. Then, a pop-up appears informing that from now on they can adjust their experience whenever they wish, by clicking on the top-right button that has just appeared on the main screen of the application.

### 3. INTERACTION CUES

To allow users to easily synchronise the TV broadcast with a second screen application, we introduced four interaction cues: the temporal indication, the illustrative animation, the overall colour, and the experience rating. The temporal indication aims at giving precise information on how the TV delay compares with the mobile application events (e.g. “app is 1.5 seconds ahead”). The illustrative animation simulates the situation corresponding to the delay specified by the users, aiming at providing them with a better perception of their choice: the animation of key events on the mobile device appear synchronised with the television, ahead, or behind it. The use of colours allows users to immediately recognize the current situation: green for synchronised (positive experience), red for not synchronised at all (negative experience) and yellow for in-between situations. To complement this cue, we also added a text describing the experience rating currently selected by the user. There are four experience ratings: “Great!”, “Good!”, “Fair.”, and “Poor...”, that range from 0s to 4s delay. The colour intervals and the experience rating values were based on the work done by Mekuria *et al.* [4].

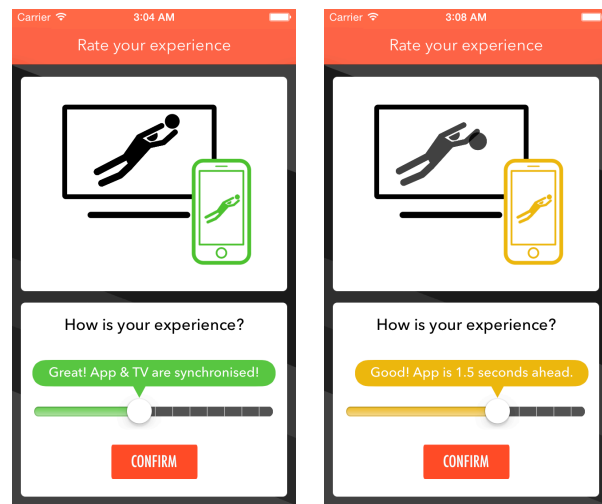


Figure 1. (a) After setting a 3s delay and (b) when further adding a 1.5s delay.

### 4. CONCLUSIONS AND FUTURE WORK

In order to evaluate SMUF’s usability and usefulness, we carried out a preliminary user study with WeSync. Users watched three 7-minute videos with pre-set random delays and by the end of each video they managed to set WeSync almost perfectly synchronised with the TV broadcast. One of the most important results was that participants stated that they had a much better experience after managing to synchronise WeSync using SMUF.

This development marks an important milestone within our work to enhance the second screen user experience during sports events. In the future, we aim to conduct further user evaluation tests in different scenarios.

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