BREAKING OUT OF THE LAB

MEASURING REAL-TIME RESPONSES TO TELEVISED POLITICAL CONTENT IN REAL-WORLD SETTINGS

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Abstract Real-time response (RTR) measurement is an important technique for analyzing human processing of electronic media stimuli. Although it has been demonstrated that RTR data are reliable and internally valid, some argue that they lack external validity. The reason for this is that RTR measurement is restricted to a laboratory environment due to its technical requirements. This paper introduces a smartphone app that 1) captures real-time responses using the dial technique and 2) provides a solution for one of the most important problems in RTR measurement, the (automatic) synchronization of RTR data. In addition, it explores the reliability and validity of mobile RTR measurement by comparing the real-time reactions of two samples of young and well-educated voters to the 2013 German televised debate. Whereas the first sample participated in a classical laboratory study, the second sample was equipped with our mobile RTR system and watched the debate at home. Results indicate that the mobile RTR system yields similar results to the lab-based RTR measurement, providing evidence that laboratory studies using RTR are externally valid. In particular, the argument that the artificial reception situation creates artificial results has to be questioned. In addition, we conclude that RTR measurement outside the lab

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is possible. Hence, mobile RTR opens the door for large-scale studies to better understand the processing and impact of electronic media content.

Almost eighty years ago, the research group of Paul F. Lazarsfeld developed the “program analyzer”—a machine to capture immediate audience reactions to radio broadcasts (e.g., see [Peterman 1940](#); [Hallonquist and Suchman 1944](#)). Using two buttons—one for positive responses and another for negative responses—recipients were able to evaluate radio programs *during* reception. Because audience reactions were available on a second-by-second basis, it was possible to identify those parts of the program people liked and disliked. Because subjects did not have to retrieve personal “likes” and “dislikes” after reception, various factors that negatively affect judgments in surveys—for example, failing memories, rationalizations, or social desirability—could be reduced or even eliminated by using this technique. Hence, the program analyzer was an early tool to investigate human information processing.

Although the program analyzer provided researchers with unique data, the idea of real-time response (RTR) measurement fell into oblivion. Whereas few academic studies made use of this invention ([Hovland, Lumsdaine, and Sheffield 1949](#); [Merrill 1956](#); [Steeper 1978](#)), outside of academia RTR measurement was quite popular and further developed. For instance, new RTR systems using dials or sliders were introduced, allowing recipients to respond in a more differentiated way to the stimuli to which they were exposed ([Twyford 1953](#); [Levy 1982](#); [Millard 1992](#)).

Currently, RTR measurement is undergoing a renaissance in academic research. This is especially true for political communication research. This approach is becoming increasingly popular for the analysis of televised political ads ([Biocca 1991](#); [Kaid 2009](#)), televised debates ([Jarman 2005](#); [Reinemann and Maurer 2005](#); [Schill and Kirk 2014](#)), and regular television programs, including social and political topics ([Kaid, Tedesco, and Jones 1996](#); [Meyer and Ségur 2009](#)). In addition, RTR technique is also used to investigate particular research questions, such as comparisons of the impact of verbal and nonverbal messages ([Maier and Maier 2009](#); [Nagel, Maurer, and Reinemann 2012](#)).

Ever since the invention of the first RTR system, its reliability and validity have been important issues. In general, research demonstrates that RTR measurement yields reliable and (internal) valid results: usually, variations of the audience’s real-time reactions can be plausibly explained by stimulus content ([Peterman 1940](#); [Thorson and Reeves 1986](#); [Maier et al. 2007](#)). In addition, assessments of reliability with test-retest, split-half, or parallel-test designs show at least moderate positive correlations (e.g., [Schwerin 1940](#); [Hughes and Lennox 1990](#); [Fenwick and Rice 1991](#); [Maier et al. 2007](#)). Furthermore, correlations between RTR data and other variables usually turn out as expected. For instance, supporters of a particular party respond positively to statements of

“their” candidate (e.g., [Hallonquist and Suchman 1944](#); [Hughes and Lennox 1990](#); [Boyd and Hughes 1992](#); [Maier et al. 2007](#)).¹

With respect to external validity, RTR has been criticized for several reasons. First, some argue that the use of RTR input devices might distract subjects from the media stimulus (e.g., [Biocca, David, and West 1994](#)). Although recipients do not feel hindered when using RTR technique ([Maier 2013](#)), experiments show that the use of dials has a slightly negative impact on the recall of visual information. Of course, this can affect evaluations ([Reinemann and Maurer 2009](#)). On the other hand, RTR data tend to lack external validity if recipients are exposed to media stimuli showing a high level of conflict ([Maier 2012](#)). Second, some scholars express concern that RTR measurement is restricted to a laboratory environment due to its technical requirements ([Hallonquist and Suchman 1944](#); [Maier et al. 2007](#)). The key problem with the laboratory environment is artificiality: most RTR studies require subjects to sit together in a large room, collectively exposed to a media stimulus. As most people normally watch TV at home—alone, or together with a small number of family members or friends—this laboratory situation is, of course, far from natural. In addition, participants could influence each other when they, for example, observe their seatmate switch the control unit in a particular direction. Another concern is that the number of participants used in RTR laboratory studies is quite small. Hence, to increase the external validity of RTR measurement, it is important to find a way to capture real-time responses outside the lab.

Recently, [Boydstun et al. \(2014\)](#) recommended the use of smartphones to solve this problem. They provided a smartphone app to more than 3,300 students all over the United States and successfully recorded instant reactions to a presidential debate. Unfortunately, their study employed push-button technology, which allows only for dichotomous responses. Also, it does not report any comparative data or synchronization tools that allow for the testing of reliability and validity.

This paper proposes a different approach to mobile RTR measurement. Independent of the work by [Boydstun et al. \(2014\)](#), we developed a smartphone app to measure real-time responses to televised stimuli using dials. In the next step, we describe the design of our mobile RTR app and our data. After that, we provide results on the reliability and validity of mobile RTR measurement by comparing data collected via smartphone with data collected in the lab.

Data and Methods

On the evening of September 1, 2013, the only televised debate in the run-up to the German national election took place. Three weeks before Election

1. In addition, a very few studies combine RTR data with physiological data (e.g., [Fahr and Fahr 2009](#)).

Day, Chancellor Angela Merkel—head of the government consisting of a coalition between the Christian Democrats (CDU/CSU) and the Liberal Party (FDP)—and the top candidate of the Social Democrats (SPD), Peer Steinbrück, discussed the most important problems facing the country in a debate lasting ninety-three minutes. The debate was aired by five TV stations and watched by 17.7 million citizens. As in former election campaigns, the debate turned out to be the most important single campaign event (Maier and Faas 2011, 76).

In order to investigate the feasibility of mobile RTR measurement, we invited thirty-two students of the University of Koblenz-Landau to watch and evaluate the debate at home.² All participants were equipped with an HTC One V Black Obsidian smartphone featuring a preinstalled app called “mobile RTR.” Students were personally instructed by the authors on how to use the smartphone and how to run the app. In addition, we provided them with an informational sheet explaining the necessary steps to run the app. The app provided two independent sliders for each candidate, running on a seven-point scale from 1 (“very negative impression”) to 7 (“very positive impression”) and operating in the “latched mode”; that is, the current dial position persists until a different position has been chosen (Baggaley 1987). The name, a photo, and the party affiliation of each candidate were displayed. Furthermore, the current slider position was displayed next to the slider bar (see figure 1). All slider positions were recorded on a second-by-second basis and automatically time-stamped. The most important challenge when measuring RTR via smartphones is to synchronize the collected data. We decided to ask all subjects to record a thirty-second audio sample of the TV program before they started RTR measurement. Based on the structure of the audio signal, we were able to compare each of the samples with a master record of the whole program. Applying a specific algorithm, we could automatically eliminate individual time lags. After the debate, participants were asked to transfer the data (plus the audio sample) to our university server simply by touching a specific button. In addition, all participants were asked to fill out online questionnaires before and after the debate. These questionnaires included questions about political attitudes, intended voting behavior, demographics (pretest only), the candidates’ perceived debate performance, the reception situation, and the usability of the app (posttest only).³

2. All participants received an incentive of fifteen euros or course extra credit. The average age of the respondents was 24.4 years (minimum 20 years, maximum 33 years), and 56.2 percent of the participants were female. Most (53.1 percent) supported parties of the opposition (SPD, Green Party, Left Party), 15.6 percent had a party identification with one of the governing parties (CDU/CSU, FDP), and 31.3 percent had no party identification. All students were entitled to vote in the national election.

3. The pretest questionnaires were filled out between August 28 and September 1, 2013. The posttest questionnaires were filled out between September 1 and 5, 2013.

Figure 1. Real-Time Response (RTR) Mobile System.

To explore the reliability⁴ and validity of the mobile RTR measurement, we compare the results with a sample of thirty-seven young and well-educated voters.⁵ The sample is part of a larger experimental study on the effects of the 2013 televised debate and belongs to the German National Election Study.⁶ Citizens eligible to vote were invited to watch the debate live at the Universities of Koblenz-Landau and Mainz. Immediately before and immediately after the debate, the participants were asked to fill out questionnaires similar to the smartphone study.⁷ During the debate, they were asked to spontaneously evaluate the candidates using an RTR dial system (see figure 2). The dial—which is also operating in the “latched mode”—has a seven-point scale from 1 (“very positive impression of Steinbrück or very negative impression of Merkel”) to 7 (“very negative impression of Steinbrück or very positive impression of Merkel”).⁸ The individual dial positions were recorded on a second-by-second basis and automatically time-stamped.

4. Reliability is assessed employing a parallel-test design. Other options to test reliability are test-retest and split-half test designs (Maier et al. 2007). Of course, both versions are not meaningful in the context of this paper.

5. All participants received an incentive of twenty-five euros. Less than half (45.9 percent) of the participants were female. The average age was 25.4 years (minimum 18 years, maximum 39 years), and 24.3 percent had a party identification with CDU/CSU or FDP, 54.1 percent supported SPD, Green Party, or Left Party, and 21.6 percent indicated no party identification. None of these measures are significantly different from the smartphone sample.

6. Download via www.gesis.org/en/elections-home/gles/data-and-documents/.

7. In addition, participants were asked to fill out a third questionnaire a few days after the debate and a final questionnaire after Election Day.

8. Because the candidates were able to speak without major disruptions—interruptions by the political opponent were rare—dials provide useful data.

Figure 2. Real-Time Response (RTR) Dial System.

In order to compare the results of the two studies, we calculated the balance between the ratings for Merkel and Steinbrück in the smartphone study.⁹ Because previous studies indicate that party identification affects real-time responses to candidates competing in televised debates (Maier et al. 2007; Boydston et al. 2014), for both studies three different time series were aggregated (one for participants identifying with a governing party, one for participants identifying with an opposition party, and one for participants without any or another party identification). After that, these time series were averaged and z-standardized (for this procedure, see also Maier et al. 2007).

Results

Reliability of RTR measurement can be investigated by analyzing how congruent the curves of the two RTR systems are (Maier et al. 2007). Figure 3 indicates that the course of the curves is mostly parallel. The two time series each consisting of 5,599 seconds show a correlation of Pearson's $r = .51$ ($p < .001$).¹⁰ Compared to the correlation between dial and push-button systems ($r = .38$; Maier et al. 2007, 63), the relationship between dials and the mobile

9. Although comparing mean scores is the standard in testing the reliability of RTR measurement, comparisons of the variance of RTR ratings or the frequency of changing dial positions can also provide meaningful insights into the (dis)similarity of RTR techniques.

10. In addition, there is a significant ($p < .001$) positive correlation between the time series for different groups of party identification (identification for a governing party: $r = .44$; identification for an opposition party: $r = .33$; no/other party identification: $r = .33$). As the correlations for the subgroups are lower than for the full sample, it seems that small sample sizes decrease reliability.

RTR system is stronger. The correlation further increases if we focus only on messages addressed by Merkel ($r = .52$, $p < .001$, $N = 2,110$ seconds) and, respectively, Steinbrück ($r = .63$, $p < .001$, $N = 2,172$ seconds).¹¹

Nevertheless, in a few sections the two curves move in different directions (i.e., positions 1 and 2 in figure 3). In position 1, participants of the lab study reacted in favor of Steinbrück when he attacked Merkel on the issue of corporate taxes and minimum wages. In contrast to this, students equipped with smartphones were in favor of Merkel. In position 2, subjects disagreed in the evaluation of Merkel's closing statement. Whereas participants of the lab study showed support for her statements, members of the smartphone study did not agree with her. In addition to the opposite directions of the curves, in some intervals participants of the lab study reacted more extremely than subjects involved in the smartphone study (positions 3 to 7). In other intervals, the

Figure 3. Mean of Standardized RTR Scores of the Laboratory (dial) and the Smartphone (mobile) Data Collection during the Course of the Debate.

11. Unfortunately, no standard exists for measuring the reliability of the correlation for RTR measurement. According to [Bachl \(2014, 60\)](#), the correlations reported here reflect a medium level of reliability.

opposite is true (positions 8 to 10). Whereas a perfect match of the dial and the mobile RTR system could not be expected—in fact, the used scales differ and require divergent types of judgments about the performance of the candidates (see also [Maier and Faas 2009](#))—the highlighted differences in reactions to the debate are, of course, difficult to explain. One reason for this could be that the smartphone study is based on a student sample whereas the lab measurement is based on a citizen sample.

Validity of the two RTR measurements can be investigated by analyzing the relationship between real-time responses and related variables (construct validity) or a latent external criterion (criterion validity; see [Maier et al. 2007](#)). With respect to construct validity, the RTR score and party identification are correlated in the expected positive direction in the laboratory study. This association is marginally significant ($p = .055$).¹² For the smartphone study, the relationship is much stronger ($p < .01$).¹³ If we focus on criterion validity, we find a highly significant correlation between the RTR score and the perceived debate winner in the expected direction in both studies ($p < .001$).¹⁴

Finally, if we set up a path analysis for both RTR measures including these three variables, the relationships follow a structure well known from previous research on German debates ([Maier 2007](#); [Maier et al. 2007](#); [Bachl 2013](#)). For the first part of the analysis, the RTR score serves as the dependent variable and party identification as the independent variable (see [figure 4](#)). For both studies, the impact of party identification is positive and statistically significant (laboratory study: $\beta = .36, p < .05$; smartphone study: $\beta = .59, p < .001$), indicating that party identification for a governing party is associated with higher RTR ratings for Merkel. In contrast to this, supporters of left-wing parties react in favor of Steinbrück. For the second part of the path analysis, the RTR score and party identification serve as independent variables in order to explain the perceived debate winner. The RTR score proved to be the most important variable. The positive sign of the coefficient indicates that the more an individual is in favor of Merkel (or Steinbrück), the higher the likelihood that recipients declare her (or him) as the winner of the debate (laboratory study: $\beta = .67, p < .001$; smartphone study: $\beta = .77, p < .001$). In contrast to this, the impact of party identification on the perception of the debate winner is insignificant for both forms of RTR

12. Identification for a governing party: 4.18; identification for an opposition party: 3.68; no/other party identification: 3.72. RTR score ranges from 1 (advantage Steinbrück) to 7 (advantage Merkel).

13. Party identification for a governing party: 1.56; party identification for an opposition party: -1.97; no/other party identification: .28. RTR score is the balance between the RTR score for Merkel and for Steinbrück, with a minimum of -6 (advantage Steinbrück) and a maximum of +6 (advantage Merkel).

14. Merkel won the debate: 4.36 (laboratory study)/2.32 (smartphone study); Steinbrück won the debate: 3.46/-2.70; no winner: 4.04/-..56.

Figure 4. Path Model Explaining the Perceived Debate Winner with RTR Score and Party Identification for the Laboratory and the Smartphone Study. * $p < .05$, ** $p < .01$, *** $p < .001$; first coefficient: laboratory study; second coefficient: smartphone study.

measurement (laboratory study: $\beta = .07$, $p > .05$; smartphone study: $\beta = .14$, $p > .05$).¹⁵

Conclusion

Given the fact that citizens get more and more information about society and politics via (electronic) mass media, it becomes increasingly important to understand how they process the provided content and what its impact is. One means of achieving this understanding is to use RTR measurement. In this paper, we presented a mobile RTR system operating with a smartphone app. Based on data from the 2013 German televised debate, we demonstrated that the mobile system yields similar results as a lab-based RTR measurement. Our results provide evidence that laboratory studies using RTR are externally valid. In particular, the argument that the artificial reception situation creates artificial results has to be questioned.

Of course, our design has limitations. It does not compare the smartphone app inside and outside the lab. Strictly speaking, we cannot be sure that the reception of the debate in a real-world setting confounds the results for the

15. Most participants in the smartphone study (81.3 percent) watched the debate with other people. If we control for this in the path model, there is neither a significant impact of the reception situation on the RTR score ($\beta = .10$, $p > .05$) nor on the perceived debate winner ($\beta = -.06$, $p > .05$). In addition, party identification has no significant impact on the reception situation ($\beta = .08$, $p > .05$). Furthermore, considering the reception situation does not change any of the reported effects.

smartphone group—although our data provide no indication that the presence of other people has affected spontaneous reactions to candidates or the perception of the debate winner. Hence, further research should clarify this objection—ideally with a larger sample size. As our results suggest that RTR measurement outside the lab is possible if some serious technical problems are solved, this problem could be easily addressed.

Mobile RTR opens the door for large-scale studies to better understand the processing and impact of TV and radio broadcasts. Because issues regarding processing and effects of media content are, of course, not restricted to politics, mobile RTR systems can provide general insights into the anatomy of public opinion formation. As using a smartphone for evaluating news, commercials, movies, and so on can also be fun, this technology might attract people usually not willing to participate in scientific studies. In sum, mobile RTR technique can be very helpful for social scientists to test the mechanisms underlying information processing and attitude change in a real-world setting with fine-grained real-time data from large and diverse populations.

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