

# Kinomatics: A global study into Cinema Data

Colin Arrowsmith<sup>1</sup>, Deb Verhoeven<sup>2</sup>, Alwyn Davidson<sup>2</sup> and Bronwyn Coate<sup>2</sup>

<sup>1</sup> School of Mathematical and Geospatial Science, RMIT University

<sup>2</sup> School of Communication and Creative Arts, Deakin University

Email: colin.arrowsmith@rmit.edu.au

## Abstract

This paper describes a creative industries research project that has applied quantitative approaches commonly used in scientific research to the study of international cinema performance. Using film screening data collected over a two year period, this paper discusses analysis of a global dataset using Appadurai's "-scapes" framework. We have identified several of these "-scapes" that help us investigate film industry behaviour. Concentrating on Appadurai's "Technoscape" an investigation into the geographic spread and distribution of a new and emerging technology, High Frame Rate cinema, has been made. HFR films have screened around the world to mixed reviews. Geographic distribution of HFR technologies and change in this distribution has also been uneven.

**Keywords:** geospatial analysis; cinema; digital humanities; cultural data

## Introduction

To date, the study of cinema has been predominantly concerned with issues of film content (the text) and with little regard for the events that occur around the actual consumption of film (Bowles and Maltby, 2009). By shifting the focus from film content to cinema as a cultural practice we can open the way for new questions and approaches to research that effectively draws together a number of discipline areas. In particular the advent of big data has meant that a wider range of digital data types, formats, and sources can be used in innovative ways by all disciplines including the humanities and social sciences. The availability of big cultural data enables the unprecedented mapping of the industrial geometry of motion pictures at an international scale.

In this paper we discuss a project called the Kinomatics Project that seeks in part to understand the relationships and patterns that are formed through the global consumption of cinema. We set out with the objective of investigating the flow and behaviour of international film screenings. This stems from earlier work by Verhoeven (2007) and Arrowsmith et al (2014) that examined the flow and movement of Greek Film in Melbourne and Sydney. However unlike that study what has become evident is that in a world of digital media, the volume of multiple screenings at the global level has changed. This has resulted in a methodological change in approach to the research.

## Methodology

This research has enabled a number of researchers from differing backgrounds to come together in a collaborative project. Humanities have traditionally relied on qualitative approaches, whereas the sciences used quantitative methods. Early studies in the digital humanities was seen as "Digital computing" (Berry, 2014), and merely replicated what was traditionally undertaken in manual or analogue methods, and converted these to digital formats. "Digital humanities" was taken to be an application of computing to humanities or a case of getting humanities based data into the digital format and moves beyond the computational replication of humanities methods. This work includes creating digital collections of archival and historic resources and data, text analytics, network analysis, and GIS applications. The Spatial Humanities has become a term which is gaining momentum within the digital humanities with a particular emphasis on Historical GIS. The Kinomatics Project is an example of the application of a Digital Humanities approach to creative industries analysis.

Over an 18 month period, we have tracked the global flow of film screenings by gathering specific cinema location information for over 68,000 films throughout 48 countries internationally. For each of these 48 countries we have data for every film screening event (down to date and time for each screen) for all venues (a global total of more than 30,000 see figure 1) resulting in a database of more than 190 million records. Data was obtained from a third party source and is directly downloaded to the project database. Their data comes directly

from cinema venues mostly through automated electronic means and also email and phone calls. Until now, databases dealing with cinema consumption and exhibition have been limited to case studies that are either national scope or defined by special interests. Examples include, historical database initiatives such as the substantial Dutch database “Cinema in Context” (Dibbets, 2013) and the “Cinema and Audiences in Australia Project” (CAARP) database (Verhoeven, 2013) as well as the GIS based work of Robert C. Allen (2013) at the University of North Carolina and the “Australian Cinemas Map” database in Australia. This project extends the scope of such databases by taking it to an international scale, to create the first global study of the film industry.



Figure 1: Map of venues for 48 countries

Figure 2 illustrates the conceptual model used for data storage. Data is currently stored on a server at Deakin University using RedHat Enterprises Linux (RHEL) using a standard MySQL 5.1.67 database. Whilst this has worked sufficiently well to date, recent searching has shown that we are extending the limits of the MySQL database and future moves to an Oracle database may be necessary.

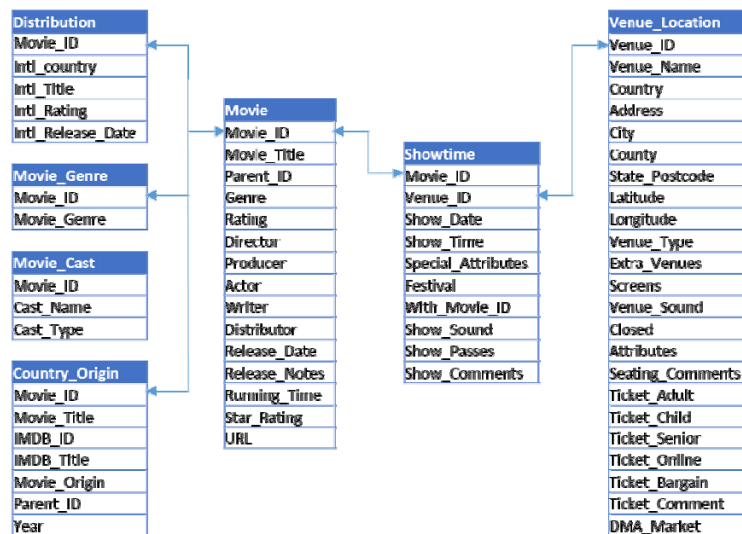


Figure 2: Conceptual database model for film screening data.

With such a richness of screening data, methods for sorting through the data are required to identify key observations. “Big data” such as our screening data, has challenged our traditional and scientific approaches to research. Rather than setting out with a hypothesis based on observation, making observations about events and testing these observations, the approach has been exploratory where patterns are being identified in the data and explanation follows from these observations. Given the approach to the analysis, we required an appropriate framework in order to proceed with the analysis and develop some general patterns that could emerge from the data. Given the global nature of the data, and the premise that interactions between countries should emerge from the observations, we adopted Appadurai’s “Global exchange of ideas and information” approach (Appadurai, 1996). Appadurai, a social-cultural anthropologist who has studied “globalisation” has proposed global exchange of ideas and information fall under five distinct “scapes” or factors that contribute to the exchange of ideas and information (see figure 3). Appadurai uses the term “-scapes” because of “...their fluidity, their dependence on perspective; “a landscape looks different depending on how you look and who is looking” (Powell and Steel, 2011).

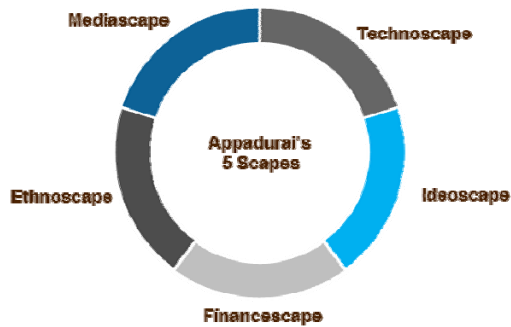


Figure 3: Appadurai's five "-Scapes".



Figure 4: Recent democracy demonstrations in Hong Kong.

(Source: <http://www.marxist.com/hong-kong-the-fight-for-genuine-universal-suffrage.htm> accessed 06/10/2014).

So for example, if we consider the photograph in figure 4 showing recent demonstrations in Hong Kong, one perspective will see a community expressing their desire through peaceful protest for democracy, whilst Chinese authorities on the other hand might consider these a threat to their notion of social order. Appadurai classifies images such as these as part of the "ideoscape" where images "...are often directly political and have to do with the ideologies of states..." (Appadurai, 1996). Mediascapes on the other hand, refer to the dissemination of information, whether it be via newspapers, magazines, or film.

The remaining three "-scapes", ethnoscapes, finanscapes and technoscapes are all interrelated (Hogan, 2010). Ethnoscapes refer to the migration of people across borders and cultures. Finanscapes consider the international exchange of money from global trade relationships as well as capital flows. Technoscapes are also closely tied with the economy and these scapes deal with the new cultural interactions and exchanges through the power of technology. Consider the Industrial Revolution in the late eighteenth and early nineteenth century Great Britain which spread to Western Europe and the USA within a few decades. This demonstrates the inter-related nature of technological innovation in driving economic growth and development, and the consequent financial flows that accompany it. It is under the ambit of technoscapes that we consider the emergence of new technology in the global flow of film screening.

### Case study: High Frame Rate and The Technoscape of The Hobbit

We selected the global screenings of the first two released films in *The Hobbit Trilogy*, *The Hobbit 1 (An Unexpected Journey)* and *The Hobbit 2 (The Desolation of Smaug)*. Director Peter Jackson selected a range of formats for filming and screening these films (reference). *Hobbit 1* and *2* were shot in what is termed a High Frame Rate (HFR) and screened in both conventional (24 frames per second (fps)) in both 2D and 3D and HFR (48 fps) in 3D (Warner Bros, 2012). The frame rate refers to the number of images displayed by a projector in one second. In the early days of film, frame rates could vary from 14 to 24 frames per second (fps) (Christie, 2014). Conventional format has been to shoot films at 24 fps. This is a legacy of early sound film where the cheapest frame rate that most clearly articulated sound was at 24 fps (Christie 2014) but also was a rate that is slighter faster than the human brain could process and therefore tricks the brain into seeing still images appearing to move on screen (Laforet, 2012), this is referred to as the "persistence of vision" effect. Jackson claimed that screening in the HFR would result in a more immersive environment for viewers; "I think HFR is terrific. As a filmmaker, I try to make my movies immersive. I want to draw the audience out of their seats, and pull them into the adventure." (Jackson cited in Lussier, 2012). Mediascapes have not been used as these concern the dissemination of film rather than the technology used to make the film and its general acceptance globally.

Using Appadurai's framework then, *The Hobbit* films provide a global example of a technoscape at two distinct levels. Firstly these films are claimed to be the first major movie film shot in HFR (Chacksfield, 2012). We can therefore examine the effect of HFR technology on global screening behaviour using this dataset, to see how effective and how quickly these films permeated the global market. At another level, Appadurai considers the "plurality of imagined worlds" in his thesis. We can consider HFR as a means of the viewer imagining themselves through *The Hobbit* films in different circumstances and different places, something that director Peter Jackson anticipated through screening at HFRs.

To date most cinemas project films using digital technology. For example, more than 37000 out of a total of 40000 screens in the US are digital, whilst in Australia this stands at around 1800 out of approximately 2000 screens, or 90% (National Association of Theatre Owners, 2014). In 2012 this stood at 72% for Australia (Given et al, 2013). In addition to a recent move from 35 mm to digital technology, HFR screenings require a further upgrade in hardware. Added to this is the requirement that the producers of *The Hobbit*, Warner Bros, required each Australian cinema to run test footage before approval was granted to screen in HFR (Swift, 2014). The additional costs, estimated at US\$75,000 per screen (Chacksfield, 2012), coupled with mixed reviews of the format, has limited the rollout of the technology. For example Village Cinemas plans to screen the HFR version of the third film in the *Hobbit* trilogy on just nine of its 212 screens, although 155 screens are capable of showing HFR content (Swift, 2014).

In our preliminary study of the data, we wanted to investigate how the higher frame-rate had permeated the screening behaviours for different countries and whether any spatial patterns had emerged. From the database, screenings for both *Hobbit* 1 and 2 were extracted earlier this year. Total screenings for the 48 countries we had data for, were 1,840,093 screenings for all formats of *Hobbit* 1. The *Hobbit* 1 shown in high frame rate came in at 87,088. This was for an entire year from December 2012 through to December 2013. December to December became our “*Hobbit* Year” because this incorporates the period of first release over the Christmas period.

Figure 5 shows a series of circular statistical outputs using Oriana software. The figure shows an apparent time lag, for Australian screenings of *The Hobbit* 1. This is shown by the mean screening as a heavier line drawn from the centre in each diagram.

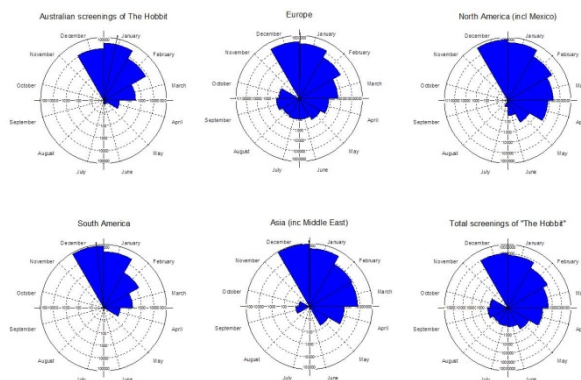


Figure 5: Circular diagrams showing delay in screenings of the *Hobbit* 1.

This lag can be attributed to the seasonality of screening. That is, the peak school holiday period for Australia coincides with Christmas and the period immediately afterwards. Most key box office releases in Australia are made in the period immediately following Christmas and general on Boxing Day. The longevity of screenings throughout Europe are probably attributable to the wider distribution across several independent nations, and language groups.

Figure 6 shows a graph of all screening for *Hobbit* 1 by region. The dominance of the North American market is the most identifying feature in this graph. What is apparent is the relative steep decay in numbers of screening in this market.

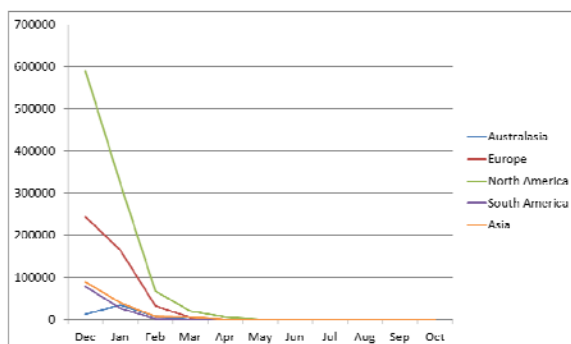


Figure 6: Monthly screenings for *Hobbit* 1 by region

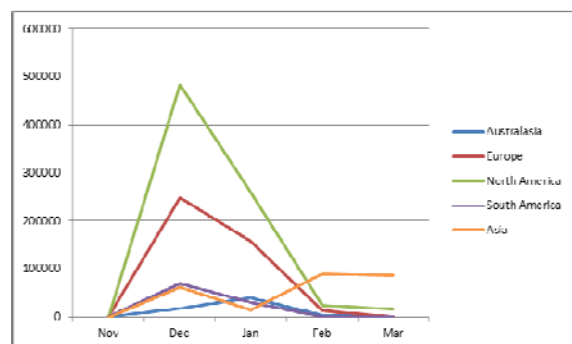
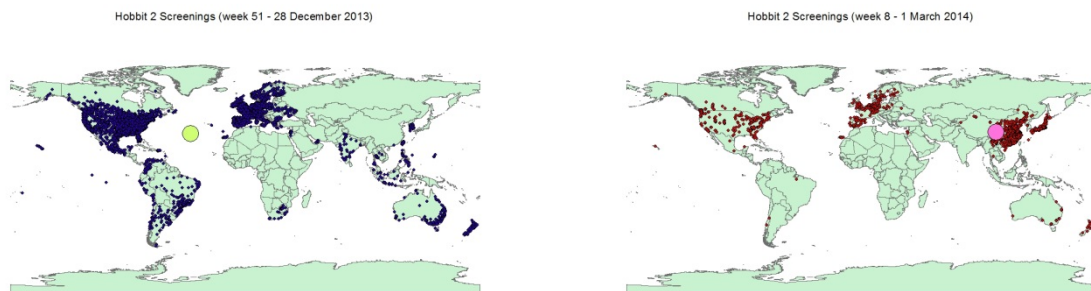


Figure 7: Monthly screenings *Hobbit* 2 by region.

For *The Hobbit 2*, total screening from December 2013 through to March 2014, resulted in 1,733,138 records being extracted. This compares to the 1,840,093 screenings for all formats of *Hobbit 1* for an entire “Hobbit Year”. Figure 7 shows screening numbers for *Hobbit 2* by region. Indications are that projected increases in total screenings for *Hobbit 2* will occur. The *Hobbit 2* shown in HFR came in with 153,252 screenings for the same period, again a significant increase over the 87,088 screenings of *The Hobbit 1*.

What is apparent from figure 7 is that whilst most screenings are made during the pre and post-Christmas period, a bi-modal peak can be seen for Asian screenings some 8 weeks after first screening. Figure 8 shows this bi-modal activity geographically. Using a geographically weighted mean centre the mean centre of screenings moves from the mid-Atlantic across to somewhere in central China. Viewings of *The Hobbit 2* in HFR have shifted in effect towards China and Japan. This may be in part due to translation.



Mean weighted centre December 2013

Mean weighted centre March 2014

Figure 8: Mean weighted centres of the screening of *The Hobbit 2*.

What was interesting to note was when venues screening in HFR were viewed geographically the increase in screening numbers was not geographically uniform, with some countries certainly increasing in viewings yet other countries significantly declining in HFR screenings. Examination of individual country venue numbers screening *The Hobbit 1* and *2* in HFR, shows that not all countries exhibited an increase in screenings. Figure 9 shows percentage change in venue numbers screening *Hobbit 1* to *Hobbit 2* in HFR whilst figure 10, shows screenings per capita in the form of a cartogram. Cartograms depict the size of an area according to some other attribute than area, in this case the number of screenings of *Hobbit 1* and *2* in HFR per capita (or head of population).

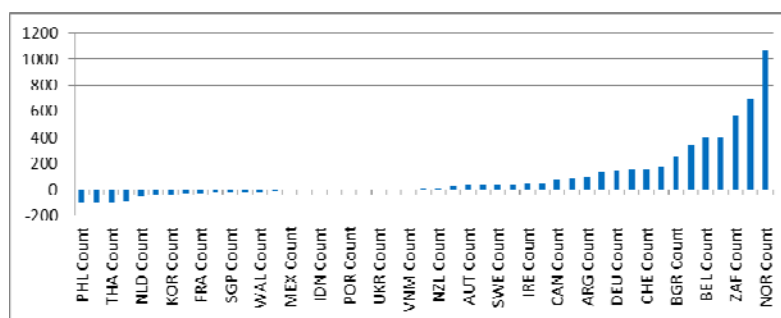


Figure 9: Percentage change in venue numbers screening *Hobbit 1* to *Hobbit 2* in HFR.

The greatest increase in numbers are for Norway (from 3 to 35), Luxemburg (1 to 8), South Africa (from 3 to 20) and in Australia (from 18 to 80). Decreases are seen predominantly in south-east Asia (see figure 11) with greatest decreases in Thailand (from 19 down to 1) and in Japan (from 23 to 2). Decreases in HFR screenings were also evident in France and The Netherlands, yet increases in screenings were detected across the border in Germany.

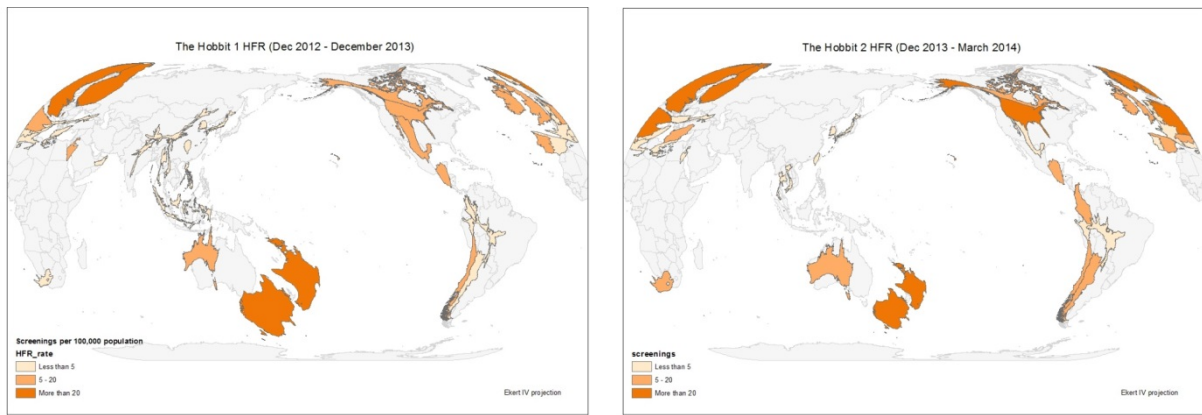


Figure 10: Cartograms showing the relative sizes of countries drawn to scale according to the number of HFR screenings per head of population.

Critics of the HFR technology claim that the technology actually detracts from the “immersive” qualities that Jackson was aiming for. According to French-American director and photographer and cinema blogger Vincent Laforet (2012): “...the magic is all gone...[the characters]...look far too real and artificial” perhaps going against the context of a fantasy film. Laforet goes on to claim that the director forces the audience to concentrate at one specific spot rather than enabling the audience to look anywhere on the screen. Other critics claim that the film “...takes on an overblown artificial quality or “harsh looking and disconnecting...”.

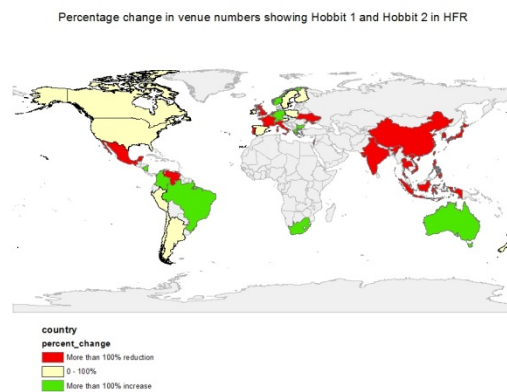


Figure 11: Geographic distribution showing change in screenings of Hobbit 1 and 2 in HFR.

It is because of these criticisms in the early release of HFR screenings of *The Hobbit*, that the producers of the Hobbit, Warner Bros, have actually limited the number of locations that screened the film in HFR (Outlaw, 2013). Nevertheless post film processing and softening the texture of the HFR productions have largely addressed many of the early criticisms.

## Conclusions

This paper has tackled a complex traditional creative industries subject, applying quantitative geographic analysis. At its broadest level, this research has demonstrated how humanities-based research can be approached from an alternative perspective, applying new methods commonly applied in scientific research to explain complex phenomena. At another level, this research provides analysis of a global dataset using Appadurai’s “-scapes” framework. We have identified several of these “-scapes” that help us investigate film screening data. Presented in the paper is how Appadurai’s “Technoscape” has been used to investigate the geographic spread and distribution of a new and emerging technology, High Frame Rate filming and screening, one that seems to be experiencing mixed reviews at a number of levels. Geographic distribution and change in this distribution has been uneven and it remains to be seen how a new release of the third film in the Hobbit trilogy will play out. Whilst the data set that we have invested in is for a two year period, it has provided a complete set of screening data for 48 countries. This has enabled us to capture seasonal trends. The data set will also provide a wealth of data for further research. One particular area of interest that is currently being investigated is the effect of film genre on duration of screening, for widely different cultural groups. This will be the focus of our next research program.

## Acknowledgements

We acknowledge the Australian Research Council for providing the funding to support this research (DP120101940).

## References

Allen, R. (ed), (2013), *Going to the Movies* [docsouth.unc.edu/gtts/](http://docsouth.unc.edu/gtts/), accessed 12 February 2014.

Appadurai, A (1996). *Modernity at Large: Cultural Dimensions of Globalization*. Minneapolis: University of Minnesota Press.

Arrowsmith, C. Verhoeven, D. and Davidson, A. (2014). "Exhibiting the Exhibitors: Spatial Visualization for Heterogeneous Cinema Venue Data", *The Cartographic Journal*, Advanced Articles Available online at: <http://www.maneyonline.com/doi/full/10.1179/1743277414Y.0000000096>, accessed 8 October 2014.

Berry, D. (2014). "Post-digital humanities: Computational and Cultural Critique in the Arts and Humanities, Educause Review Online Available online at: <http://www.educause.edu/ero/article/post-digital-humanities-computation-and-cultural-critique-arts-and-humanities>, accessed 02 October 2014.

Bowles, K and Maltby, R. (2009), *What's new about New Cinema History?*, in H. Radner, P. Fossen (eds), *Remapping Cinema, Remaking History: XIVth Biennial Conference of the Film and History Association of Australia and New Zealand*, Centre for Research on National Identity, University of Otago, NZ, Dunedin, New Zealand, pp. 7-21.

Chacksfield (2012). "High frame rates will become standard in the movies" Interview with Kevin Wines August 2012. Available online at <http://www.techradar.com/au/news/home-cinema/thx-high-frame-rates-will-become-standard-in-movies-1092616>, accessed 13 October 2014.

Christie (2014). "The future of cinema is smooth, crisp and amazing: high frame rate technology overview for exhibitors", published by Christie Digital Systems, available online at: <http://www.christiedigital.com/supportdocs/anonymous/christie-high-frame-rate-technology-overview.pdf>, accessed 02 October 2014.

Dibbets, K. (ed) (2013), *Cinema Contexts*. Available online at [www.cinemacontext.nl](http://www.cinemacontext.nl), accessed 12 February 2014.

Given J., Curtis R. and McCutcheon (2013). "Cinema in Australia: an industry profile" available online at [http://apo.org.au/files/Resource/SISR\\_CinemaInAustraliaAnIndustryProfile\\_June2013.pdf](http://apo.org.au/files/Resource/SISR_CinemaInAustraliaAnIndustryProfile_June2013.pdf), published by The Swinburne Institute, accessed 15 October 2014.

Hogan, A. (2014). "Appadurai's 5-scapes", notes submitted on 15 September 2010, Amherst College. Available online at <https://www.amherst.edu/academiclife/departments/courses/1011F/MUSI/MUSI-04-1011F/blog/node/229354>, accessed 02 October 2014.

Laforet V (2012). "The Hobbit: An Unexpected Masterclass in Why HFR fails, and a reaffirmation of what makes cinema magical". Available online at <http://blog.vincentlaforet.com/2012/12/19/the-hobbit-an-unexpected-masterclass-in-why-hfr-fails-and-a-reaffirmation-of-what-makes-cinema-magical/>, accessed 06 October 2014.

Lussier, G. (2012). "Peter Jackson Answers High Frame Rate 'Hobbit' Questions; Plus Animal Controversy and a New Sculpture" in *Film blogging the reel world*, blog posted online Nov 19 2012, available: <http://www.slashfilm.com/peter-jackson-answers-high-frame-rate-hobbit-questions-plus-animal-controversy-and-a-new-sculpture/>, accessed 15 October 2014.

National Association of Theatre Owners (2014). "Exhibition and Statistics", available online at <http://natoonline.org/data/>, accessed 15 October 2014.

Outlaw, K. (2013). "The Hobbit: Warner Bros. Will Limit High Frame Rate Showings in Theaters". Available online <http://screenrant.com/hobbit-high-frame-rate-release-showings-locations/>, accessed 13 October 2014.

Powell, J. and Steel, R. (2011). "Revisiting Appadurai: Globalizing Scapes in a Global World – the Pervasiveness of Economic and Cultural Power", *International Journal of Innovative Interdisciplinary Research*, Issue 1, December 2011.

Swift, B. (2014). "Mixed reviews for cinema tech tools", published in *The Australian Review*, available online at [http://www.afr.com/technology/mixed\\_reviews\\_for\\_cinema\\_tech\\_tools\\_NMbpiheNZ92IJyQufxxJTJ](http://www.afr.com/technology/mixed_reviews_for_cinema_tech_tools_NMbpiheNZ92IJyQufxxJTJ), accessed 14 October 2014.

Verhoeven, D. (2007). "Twice Born: Dionysos Films and the Establishment of a Greek Film Circuit in Australia", *Studies in Australasian Cinema*, 1:3, 275-298.

Verhoeven, D. (2013). *CAARP*, [caarp.edu.au](http://caarp.edu.au), accessed 12 February 2014.

Warner Bros. (2012). "The Hobbit: See it in 3D", <http://www.thehobbit.com/hfr3d/faq.html> accessed 11 June 2014.