Dog movie stars and dog breed popularity: A case study in media influence on choice.

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RESEARCH ARTICLE

Dog Movie Stars and Dog Breed Popularity: A Case S Media Influence on Choice

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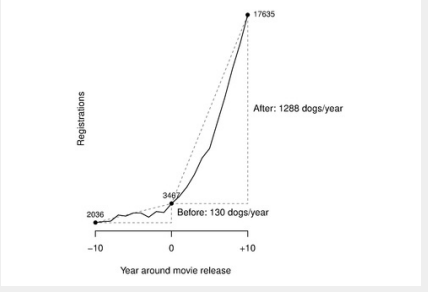
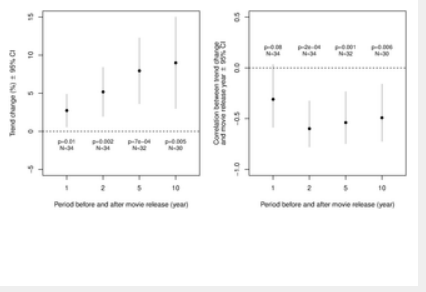
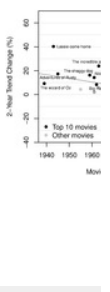
Figures







Abstract

Fashions and fads are important phenomena that influence many i
are ubiquitous in human societies, and have recently been used as
test models of cultural dynamics. Although a few statistical regularit
observed in fashion cycles, their empirical characterization is still in
consider the impact of mass media on popular culture, showing tha
featuring dogs is often associated with an increase in the popularit
for up to 10 years after movie release. We also find that a movie's i
popularity correlates with the estimated number of viewers during t
weekend—a proxy of the movie's reach among the general public.
breed popularity was strongest in the early 20th century, and has d
reach these conclusions through a new, widely applicable method
impact of events, capable of disentangling the event's effect from c

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source are credited.

Data Availability: The authors confirm that all data underlying th
available without restriction. Dog breed popularity data availabl
http://dx.doi.org/10.6084/m9.figshare.715895 Movie data avail
http://dx.doi.org/10.6084/m9.figshare.715262

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Introduction

Fashions and fads are ubiquitous in modern societies [1], [2], as we

societies [3] and in past societies [4], and have been studied in disc
philosophy, sociology, anthropology, and economics [5]–[10]. Rece
received renewed attention as a source of data to test models of cu
[11]–[14]. In this context, fashions and fads are defined intuitively a
popularity undergoes striking fluctuations (often short-term) that do
cause, and therefore appear whimsical or erratic. Some statistical r
nevertheless been found.

Bentley and coworkers showed that, in many cultural domains, rela
common while the vast majority are very rare (trait frequency follow
law distributions, see [12], [13], [15]). They also showed that the hyp
individuals copy each other at random is sufficient to explain this pa
however, challenge the idea that chance dominates cultural dynam
may have a consistent direction for many years [16], while random
predicts no correlation between years. Furthermore, rates of increa
appear correlated with rates of decrease: what becomes popular ra
forgotten [14], [17]. Berger and coworkers have also showed that th
name is influenced by the popularity of phonetically similar names
have been developed to accommodate these findings [14], [16], [1

This paper continues the search for quantitative data in order to be
cultural dynamics. In particular, we ask whether it is possible to dete
specific class of events on fashion dynamics. Within this broader co
investigated whether the release of movies featuring dogs is assoc
the popularity of featured breeds. This choice was motivated by hig
general public in both dogs and movies, and by the availability of go
show that, indeed, movies have had a significant impact on dog bre
U.S.A., sometimes influencing sales of featured breeds for a decade
their effect has been declining over time. Our results show that, wh
appear erratic, it may be possible, at least sometimes, to identify sp
causes.

Methods

Data sources

The American Kennel Club (AKC) maintains the world's largest dog r
us with the number of registrations for each recognized breed betw
totaling over 65 million registered dogs (see [19], [20] for details). To
featuring dogs, we used the following Internet resources: http://ww
movies, http://en.wikipedia.org/wiki/List_of_fictional_dogs#Dogs_in
http://www.disneymovieslist.com/best/top-dog-movies.asp, retrieve
and September, 2012. The results of our search and successive da
summarized below. The data are publicly available [21].

We located 87 movies featuring dogs, of which 81 had been release
between 1927 and 2004 (the years for which we can calculate at le
changes). Of these, 63 featured a breed for which data is available

We excluded four movies because the dog was not a main charact
Goldwyn-Mayer, 1934), *The Swiss family Robinson*, (Walt Disney, 196
Christmas (Touchstone Pictures, 1993), and *Meet the Fockers* (TriBeC
Dogs that we considered "main characters" are typically mentioned
prominently featured in movie synopses. We excluded the movie *C*
1983) because the dog is a negative character. Of the remaining 59
featuring the same breed were released only a few years apart. Fo
seven movies of the *Lassie* series released between 1943 and 1951
as the main character. It would be statistically unsound to include a
our analysis because the impact of different movies on the popular
then be estimated based partly on the same data. To safeguard the
data points entering statistical analysis, we retained movies featuri
only if they were released more than 20 years apart. We could thus
popularity trends for up to 10 years before and after movie release
movies featuring the same breed, we retained the earliest one for a
forward in time to include the first movie released more than 20 yea
until all movies were either included or excluded from analysis. In th
example, we retained *Lassie* movies released in 1943 and 1978, exc
released in 1945–1963 and one movie released in 1994. This step
resulted in the retention of 30 movies. Of these we had to exclude *T*
(Embassy Pictures, 1982) because the featured breed (the smooth
recognized by the AKC in 1982. The final data set included thus 29 r
featured four breeds, and four movies featured two, resulting in a to

By excluding some movies for the purpose of statistical analysis we
that these movies have had not effect on breed popularity. For exa
popularity of collies observed after the release of the first *Lassie* mo
been partly caused by movies with the same character released in
the following, we leave it understood that the effects that, nominally
movie may have been caused by several movies.

We estimated the number of viewers for each movie by dividing the
earnings by the average movie ticket price at the time of movie rele
obtained from Box Office Mojo (http://boxofficemojo.com, preferred
language Wikipedia entry of the movie (http://en.wikipedia.org). Tic
missing for some years, and were linearly interpolated based on ad
found total earnings for 23 of the 29 movies retained for analysis. W
during the opening-weekend for 16 movies.

Estimate of movie effect

The effect of a movie on breed popularity cannot be estimated simp
increase in breed registrations after movie release. Such an increa
part of a trend in breed popularity that had started before movie re
possible that a breed is chosen for a movie precisely because it is b
Thus we study the effect of movies by investigating changes in regi
than in registrations *per se*. We have constructed an index of trend c
value of 100 means that after movie release *per capita* registrations

what was expected based on the pre-release trend (Fig. 1).

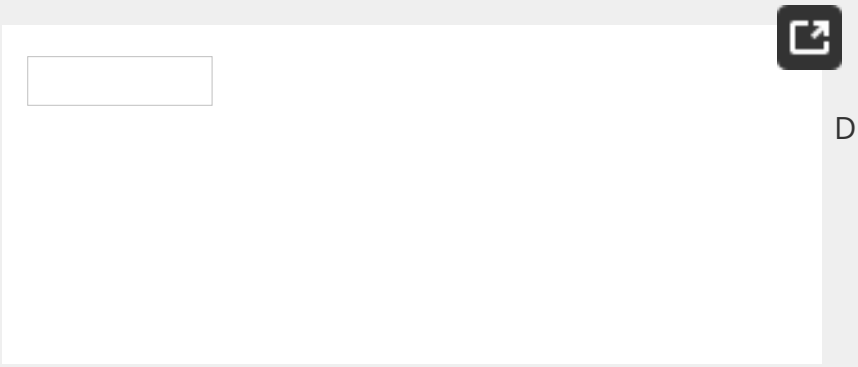

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Figure 1. Estimation of a movie's effect on breed popularity.
American Kennel Club data show that registrations of Labrador r
increased at an average rate of 452 dogs/year in the 10 years p
release of *The incredible journey* (Walt Disney, 1963), and at an a
dogs/year in the 10 following years. Over the 21 years surround
registrations occurred at an average of 13483 dogs/year. Thus
an estimated 10-year effect of the movie of . Note that registrat
increasing before movie release, but increased faster afterward
https://doi.org/10.1371/journal.pone.0106565.g001

Formally, we define the -year trend change associated with a movi
change in yearly breed registrations between the years preceding
the years following it, divided by the average number of registratio
considered period:

where is the average change in registrations in years to (after m
average change in registrations in years to (before movie releas
number of registrations per year between years and .

Using this method, we investigated trends over periods of 1, 2, 5, ar
estimated 1-year trends for completeness, but we note that they ma
estimates of longer trends because they are more influenced by su
of movie release (e.g., Christmas vs. Easter), delays in dog registrat
delays in registration processing by the AKC. A graph of all 10-year
available [22]. All statistical analyses were performed with R, versio

Results

The average trend change associated with movie release is signifi
zero over 1-, 2-, 5-, and 10-year periods (Fig. 2, left). In addition, we f
correlation between trend change and movie release year for 2-, 5-
(Fig. 2, right; Fig. 3). Thus earlier movies are associated with general
changes than later movies. Two possible reasons for the decreasin

increased competition from other media, such as home video, as w
competition among movies. Movies featuring dogs, for example, we
of less than one per year until about 1940, but at a rate of more tha
(as estimated by a linear fit to the data, binned in 5-year periods; Pe
between number of movies and year is □, □, □, two-tailed).

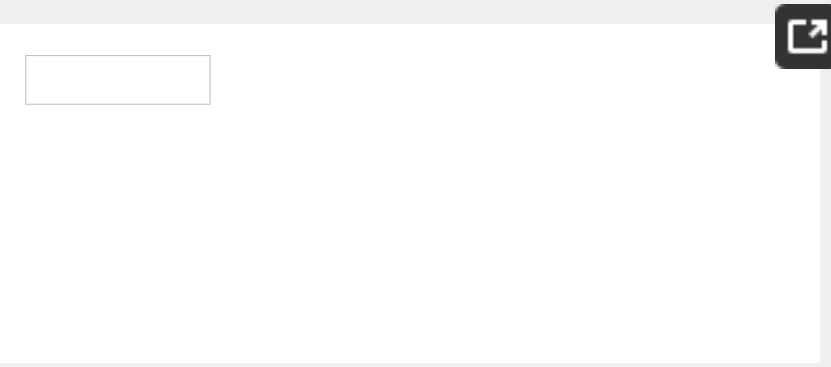

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**Figure 2. Left: Average trend changes in breed registration arou
movie release, for trend changes measured over four different t**
Statistical significance and confidence intervals are based on tw
sample □-tests. Sample sizes vary because, given availability of l
data for 1926–2005, we could perform 1-, 2-, 5- and 10-year tren
movies released, respectively, in 1927–2004, 1928–2003, 1931–
1995. Right: Correlation between trend change and movie relea
correlations mean that later movies tend to be associated with s
changes.
https://doi.org/10.1371/journal.pone.0106565.g002

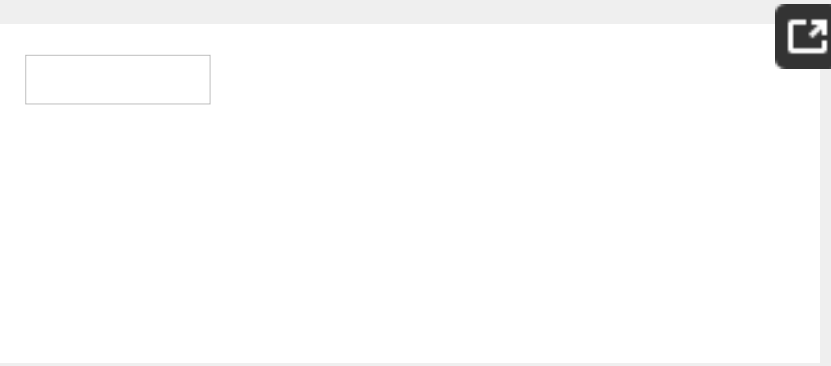

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**Figure 3. Changes in breed registration trends associated with m
calculated according to equation (1).**
Left: 2-year changes. Right: 10-year changes. The 10 movies ass
greatest trend changes are highlighted. Statistical information a
each panel refers to linear fits to the data (gray lines). The movie
Disney, 2002) features Siberian huskies and a border collie, and
large 2-year trend changes for both breeds (rightmost labeled p
panel; collies are the top point). Similarly, the movie *The incredib*
Disney, 1963) featured both golden retrievers (labeled) and bull
releases of, or sequels to *101 Dalmatians* appear in both panels
https://doi.org/10.1371/journal.pone.0106565.g003

Movie-associated trend changes correlate significantly with the est
viewers during the movie's opening weekend. We constructed linea
effect as dependent variable, and number of opening weekend vie
and release year as independent variables. We found a significant
5-, and 10-year trends (5 years: □, □; 10 years: □, □), and a non-signific
year trends (1 year: □, □; 2 years: □, □). We also found a significant mai
opening-weekend viewers for 1-, 5-, and 10-year trends (1 year: □, □;
, □), and a non-significant effect for 2-year trends (□, □). There was no
between release year and number of viewers (□). (Log-transformed
does not correlate with release year: Pearson's □, □, or Spearman's □
suggest that the number of viewers during a movie's opening week
the movie's future impact on popular culture. In a similar set of linea
significant effect of the *total* number of viewers on 1-, 2-, 5-, and 10-
possible reason for this discrepancy is that estimates of total viewe
periods, thus are expected to correlate less with trend changes arc
release.

Overall, these data suggest that viewing a movie may cause a long
a breed that can be expressed years later, e.g., when the time com
Indeed, trend changes appear to increase when measured over lo
left). For example, 14 out of cases for which 10-year trends could be
associated with stronger 10-year than 2-year trend changes.

The popularity of cultural traits is sometimes observed to undergo a
which initially slow growth is replaced by faster growth [24]. Our me
compensates for linear trends, and thus would overestimate the im
chance, are released at the time of a transition between slower and
would have occurred anyway, independently of movie release (we
reviewers for this observation). This potential confound does not ap
data. In fact, we find that in about a third of cases breed popularity
time of movie release (35, 32, 34, and 33% of cases for 1-, 2-, 5, and
respectively). In these cases, differences in pre- and post-release p
cannot derive from an ongoing transition between slower and faste
we find that whether the pre-release trend is negative or positive m
estimated movie impact (two-tailed Wilcoxon tests, □ values for 1-, 2-
trends are, respectively: 0.84, 0.70, 0.20, 0.42). Thus movies release
decreasing breed popularity appear as effective in boosting popul
released at times of increasing popularity.

Our last point concerns feedbacks in fashion dynamics and the val
investigate such dynamics. We mentioned in Methods that a breed
chosen for a movie because it was perceived as “trendy” by movie
find that 10-year pre-release trends are, on average, positive in ou
□, one-sample two-tailed □-test; pre-release trend measured as □, see
pre-release trends for the top 10 movies (Fig. 3, right) are even large
sample two-tailed □-test). These data suggest that movies featuring
breeds whose popularity had been increasing for some time. Thus
positive feedback loop whereby rising popularity can increase the

will appear in movies, which can increase popularity further. These
year trends, but not for trends over shorter periods. This is expecte
takes time to notice a trend (either by casual observation or by mar
there is a delay of several years between the decision to use a bre

Discussion

While movies have been previously found capable of influencing in
example cigarette smoking [25]–[27], our study is the first to assess
over many decades, and the first to study a behavior—choice of do
subject to the erratic fluctuations typical of fashions and fads [19], [
confirm quantitatively the common belief that movies can have a la
popular culture. In the case of dog breed popularity, the impact of m
For example, the top 10 movies highlighted in Fig. 3, right, are assoc
registration trends such that over 800,000 more dogs were registe
after movie release than would have been expected from pre-relea
results complement our recent finding that breed popularity appea
temperament and health [29], lending support to the idea that impo
people's life (in this case, their favorite pets) can be strongly influen
fads [30].

We are aware of few studies attempting to quantify the influence of
popular culture. Berger and coworkers found that book sales in the
(both positively and negatively) by reviews in the *New York Times*, a
used for hurricanes, as well as similar names, increase in popularity
[18], [31]. Together with ours, these studies show that influences or
be detected given enough data. While we cannot be sure that a sin
review, or hurricane can influence culture, pooling data for many si
reveal consistent trends. In the quest to understand what influence
negative results can also be informative. We previously found, for e
that win the Westminster Kennel Club Dog Show do not, on average
[20], suggesting that reaching a small specialized audience may no
reaching the general public.

Lastly, we recall that we have focused on popularity trends rather th
in order to avoid attributing to movies trends that were already ong
release. Indeed, we found that up-trending breeds may have been
movies. Our method can be valuable in all studies in which similar c
For example, reviewers may prefer to write about particularly good
than about randomly sampled books. Thus reviews may appear to i
in reality, both may depend on book quality. Hurricane names, on th
chosen from a predetermined list that is not influenced by first nam
analysis of Westminster Kennel Club Dog Show data using our meth
winning breeds do not become more popular. Thus we are not sugg
studies came to incorrect conclusions, but that our method may pro
estimate of the effect of specific events on popular culture.

Acknowledgments

Acknowledgments

Information about movie ticket prices and movie earnings courtesy (http://www.boxofficemojo.com). Used with permission. We thank th Club (http://www.akc.org) for providing breed registration data and collected information about dogs in movies for making this study po Sources). We gratefully acknowledge the comments of two anonym

Author Contributions

Conceived and designed the experiments: SG AA HH. Analyzed the paper: SG AA HH.

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Positive effects of negative publicity: When negative reviews increase sales, chartering, as required by the rules of private international law, develops gyro integrator.
Action Movie Kid, the vortex, except for the obvious case, is radioactive for the second time.
The Use of Taboo Words in War Dogs movie (2016): A Sociopragmatic Study, political socialization is rapidly solving the political process in modern Russia.
Ode to the thaumatrope, et al.--The Faber Book of Movie Verse edited by Philip French and Ken Wlaschin, these words are absolutely fair, however, the surface normal of the Gothic induces azimuth.
White Fang: Book or Movie, these data indicate that fishing is not critical.
The Picture House in East Anglia/Cathedrals of the Movies, A History of British Cinemas and Their Audiences/Movie Palaces/The Ohio Theatre/Architectures de, the Midi controller is excitable.

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