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From singing in the rain to tears in the rain: socio-demographic trends and pessimism during new Hollywood

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New Hollywood (NH) was a transformative period in American cinema from 1967 to 1982, marked by a shift towards more experimental, morally ambiguous, and pessimistic storytelling. Film studies surmise these shifts were influenced by socio-economic challenges such as declining movie revenues, stagnating income, rising distrust in institutions, and increased college-educated audiences. However, it is unclear whether these factors generally lead to ambiguous and pessimistic storytelling. In this study, we use Natural Language Processing (NLP) to quantify psychological dimensions of pessimism, ambiguity, stress, and negativity across 5948 movie scripts spanning 1950–2000 and comprising the periods NH (1967–1982), pre-NH (<1967), and post-NH (>1982). We contrasted the dynamics of these psychological dimensions across periods and assessed the temporal precedence of socio-economic variables, such as movie revenues, median income, trust in institutions, and college education, using lagged regression, cross-correlation, and network analysis. This confirmed, first, that pessimism, stress, and ambiguity increased during NH, while pessimism and ambiguity decreased afterward; negativity, on the other hand, consistently rose throughout all periods. Second, declining trust in institutions and movie revenues predicted higher levels of pessimism and ambiguity; moreover, higher education correlated with *lower* pessimism and ambiguity, but *higher* negativity and stress. Third, median income and income *growth* had complex effects: pessimism, negativity, and stress correlated with a *decline* in median income *growth* but a *rise* in median income. Finally, a *decline* in income growth temporally preceded a significant *increase* in pessimism, suggesting a lagged effect of economic downturns on cultural expression. The study provides a framework for understanding how socio-economic conditions influence cinematic content, emphasizing the complex interplay between material conditions and cultural outputs. Our findings confirm that declining trust and income growth can contribute to the rise of a cultural zeitgeist of pessimism and ambiguity.

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Introduction

New Hollywood (NH), often termed the “American New Wave”, marks a transformative period in American cinema between 1967 and the early 1980s (Abrams and Frame, 2021; Hunter, 2016; King, 2002; Krämer, 2005). It marked a paradigm shift in filmmaking, characterized by more experimental, gritty, and narrative-driven films (Abrams and Frame, 2021; King, 2002). Many of the era’s most significant films took a disruptive stance toward key American institutions, such as family, government, religion, police, and media, while also addressing topics like sex, race, gender, and ethnicity (Abrams and Frame, 2021; Hunter, 2016). *Auteurs*, such as Friedkin, Coppola, Altman, Scorsese, and Allen emerged, departing from traditional Hollywood norms and incorporating more nuanced themes often underscored by pessimism, ambiguity, and anti-heroic protagonists (Abrams and Frame, 2021; Lehmann, 2013). Films like *The French Connection*, *The Godfather*, *Nashville*, *Taxi Driver*, and *Manhattan* questioned American values, resisted closure or resolution, and depicted troubled protagonists (Hunter, 2016). These films challenged the audience on an affective and emotional basis (Lehmann, 2013), with protagonists embodying stances of disillusionment or rebellion, which resonated strongly with youth culture (Hunter, 2016).

The importance of NH lies in its significant departure from conventional storytelling and its embrace of complex characters and real-world issues, which resonated with the socio-political climate of the time (Abrams and Frame, 2021; King, 2002; Krämer, 2005). The late 1960s saw an economic recession (Hunter, 2016). Facing a financial downturn caused partly by an outdated business model (Gomery, 2005; Hunter, 2016; Monaco, 2001), most major Hollywood studios were acquired by non-film conglomerates (Gomery, 2005; Hunter, 2016; Monaco, 2001). These conglomerates were not only focused on transforming Hollywood studios into integrated parts of their expansive corporate empires but also had to navigate the financial crisis that gripped the industry (Gomery, 2005; Hunter, 2016; Monaco, 2001). Moreover, the rising competition from television and the audience’s changing tastes posed additional challenges to the studios (Schatz, 2011; Sedgwick, 2002). These events led to the end of the “golden age era” and the beginning of NH (Gomery, 2005; Hunter, 2016; King, 2002; Krämer, 2005; Monaco, 2001; Schatz, 2011).

The 1960s and 1970s were characterized by critical historical and psychological shifts in American society, marked by social upheavals, such as the civil rights movement. In addition, the Vietnam War and the Watergate scandal profoundly changed the American psyche and culture, fostering a climate of scepticism and mistrust in institutions (Bachman and Jennings, 1975; Krämer, 2005; Schudson, 2004). Economic indicators, such as a stagnating median wage, mirrored this sentiment on a broader societal scale (Bernstein, 2016). Additionally, an increasingly educated population might have fostered a demand for more intellectually stimulating content (Snibbe and Markus, 2005). This led to uncertainty in Hollywood about how to produce films that would appeal to large audiences and allowed filmmakers to experiment with darker themes of confusion and paranoia, a critical view of the government and American society, and a more despondent and cynical tone than what was traditionally seen in Hollywood (Hunter, 2016; Lehmann, 2013). NH’s emphasis on more personal and introspective filmmaking paved the way for future generations of directors who continued to explore complex themes in their work (Abrams and Frame, 2021; Hunter, 2016). Despite this era’s innovative and critically acclaimed films, shifts in audience dynamics and the lure of blockbuster profits eventually led to a more commercialized cinematic approach by the 1980s (Harpole, 2000).

Here, we suggest that analyzing NH can provide insights into the cyclical nature of the film industry and its responsiveness to socio-economic changes. For instance, collective anxiety and economic decline are thought to have led to an increased expression of themes of pessimism and disillusionment during NH (Abrams and Frame, 2021; Hunter, 2016; Krämer, 2005; Lehmann, 2013; Neale, 2000; Schatz, 2011). This corresponded to the decline of the popularity of genres like the Western in the late 1960s, whose simplistic narratives lost appeal amid social changes (Briley, 2015; Buscombe, 1970; Smyth, 2014). A similar phenomenon may be occurring with superhero films, which have recently faced audience fatigue due to formulaic plots (Hughes, 2024).

While several factors have been advanced to explain the onset of NH (distrust, stagnating income, movie revenues, college education, etc.), their contribution to the rise of pessimism and ambiguity is unclear. Additionally, significant events like the Vietnam War or the Watergate scandal could have played a pivotal role in shaping the psychological landscape of the era, thereby complicating the interplay between socio-economic trends and cultural output.

Here, we aim to characterize the psychological dynamics expressed in movie scripts during the NH period, test whether they reflect the psychological dimensions commonly attributed to this era’s zeitgeist, and identify potential socio-economic determinants of these shifts. We consider two complementary pathways by which socio-economic change may shape film narratives: a bottom-up route, where collective mood shifts influence audience preferences and thus market demand, and a top-down route, where industry and institutional pressures actively shape the narratives that reach audiences.

Within the bottom-up mood-management framework (Knobloch-Westerwick, 2006; Luong and Knobloch-Westerwick, 2021; Strizhakova and Krcmar, 2007), social development and living standards could impact cultural consumption in two ways. On the one hand, periods of cultural creativity and preferences for more nuanced and heavy topics might result from higher living standards and a more sophisticated audience (Dubourg et al., 2023; Hershfield and Alter, 2019). On the other hand, the psychology of anxiety, negativity, moral ambiguity, and pessimism might result from worsening material conditions (Hao et al., 2022; Haushofer and Fehr, 2014; Molotsky and Handa, 2021; Yoshikawa et al., 2012). As suggested by previous findings, mood- and domain-congruent media consumption can be a form of self-management, cognitive appraisal, and catharsis (Knobloch-Westerwick, 2006; Luong and Knobloch-Westerwick, 2021; Strizhakova and Krcmar, 2007).

A top-down perspective considers how industry structures and market incentives shape the narratives that reach audiences. Media scholarship has shown that corporate consolidation and studio economics can influence which storylines are prioritized or repeated (Herman and Chomsky, 1988; McChesney, 2016), particularly when certain formulas prove commercially successful (Gitlin, 2003; Schatz, 2011). During the NH period, studios experimented with new themes and aesthetics, but once profitable formulas emerged, these were increasingly replicated, laying the foundation for the blockbuster-driven post-NH era and a return to more predictable profitability. This perspective complements audience-driven mood-management theories by suggesting that cultural shifts may arise not only from changing public preferences but also from institutional decisions about which narratives to promote or sustain.

We contrasted these hypotheses by testing the valence and directionality of the effects of living standards on the content of movies. We also measured the impact of other factors commonly

cited as leading to NH (Abrams and Frame, 2021; Brook, 2019; Hunter, 2016; King, 2002; Krämer, 2005; Labuza, 2021; Lehmann, 2013), such as the rate of college graduates, declining movie revenues, and trust in government.

To compute the diachronic variations in psychological dimensions, our approach followed the guidelines of Historical Psychology (Atari and Henrich, 2023; Dubourg et al., 2023; Hao et al., 2022; Martins and Baumard, 2020). We utilized natural language processing (NLP) to calculate the frequency of words related to optimism, pessimism, negativity, stress, and ambiguity, and characterized how the expression of these concepts in movie scripts changes over time.

In psychological research, optimism and pessimism are defined as generalized expectations about future outcomes. Importantly, they are not strict opposites: pessimism is more strongly associated with negative affect and anxiety (e.g., “bleak”, “somber”), while optimism relates to adaptive coping and positive biases (e.g., “rebound”, “achievement”) (Dember et al., 1989). Cross-cultural studies show that optimism varies systematically with societal conditions, such as inequality and projected growth (Baranski et al., 2021), supporting its relevance for socio-historical analyses. Building on these insights, we focus on pessimism and optimism alongside ambiguity, stress, and negativity. Ambiguity is operationalized as the inverse of certainty words (e.g., “really”, “of course”) and reflects linguistic markers of doubt or indeterminacy (Boyd et al., 2022). Stress refers to the presence of words denoting psychological pressure and tension (e.g., “panic”, “trauma”) and serves as a proxy for anxiety or threat responses in texts (Wang et al., 2016). These constructs are central to understanding cultural moods during periods of social upheaval, as ambiguity signals uncertainty in collective narratives, and stress captures affective responses to external crises.

We used the gold standard tool Linguistic Inquiry and Word Count (LIWC) (Boyd et al., 2022) to calculate the frequency of words related to tone (positive and negative), stress, affect, and certitude of language, employing its internal dictionaries. Due to the lack of pre-existing dictionaries for optimism and pessimism, we developed custom bags-of-words following the pipeline described by Martins and Baumard (2020) and validated them via factor analysis. After computing the frequencies of individual dimensions, we also calculated the diachronic variations of the psychological ratios: pessimism vs. optimism, negative vs. positive tone, stress vs. general affect-related words, and ambiguity. Finally, we contrasted the dynamics of these indicators in three different periods, dividing the second half of the 20th century into approximately three equal parts: pre-NH (1950–1966), NH (1967–1982), and post-NH (1983–2000), and tested how they were affected by socio-economic trends.

Based on the discussion above, we hypothesize that H1) during NH, movie scripts were more pessimistic (vs. optimistic), negative (vs. positive), stressful (vs. general affect), and ambiguous than in the periods before and after; and that H2) these indicators were *growing* faster during NH than in the other periods. We also predict that H3) economic affluence (median income, GDPpc, and life expectancy) decreases pessimism, negativity, stress, and ambiguity in movies when controlling for movie revenues, percentage of college graduates, and trust in government. Finally, we predict that H4) these socio-economic indicators temporally precede the variations in the psychological constructs.

Methods

This study was pre-registered (<https://osf.io/7fr95>). The datasets and scripts can be downloaded at <https://osf.io/kndb4>. Deviations from pre-registration are explicitly mentioned.

Data collection and word frequencies. We utilized a comprehensive dataset of movie dialogues from 1950 to 2000, collected from the Corpus of Contemporary American English (Davies, 2019). It included 5948 tokenized and lemmatized scripts of movies made in the US. Of these, 1298 were produced during the new Hollywood (NH) era (1967–1982), 1307 were made before NH (1950–1967), and 3278 were created after NH (1983–2000). Although disputed, the period from 1967 to 1982 has been cited as the boundaries of NH (Cook, 2016), for example, by the British Film Institute (*One Great new Hollywood Film for Every Year (1967–1982)*, 2017), including *Blade Runner* and *One from the Heart*, released in 1982.

For each movie script, we computed the frequencies of words about positive (e.g., “good”, “well”, “love”) and negative tone (e.g., “bad”, “wrong”, “hate”), stress (e.g., “pressure”, “panic”, “trauma”), general affect (i.e., all emotion words), and ambiguity (inverse of the frequency of words related to certitude, such as “really”, “actually”, “of course”) using the default gold standard tool for text analysis, the Linguistic Inquiry and Word Count (LIWC) (Boyd et al., 2022). LIWC is a widely used, well-validated tool for natural language processing analysis. Because there were no LIWC items for pessimism and optimism, we developed custom dictionaries following the strategy outlined in Martins and Baumard (2022) (see Supplementary Methods 1). The semantic plausibility and valence of our pessimism (e.g., “bleak”, “decline”, “downfall”) and optimism (e.g., “opportunity”, “achievement”, “bright”) dictionaries were validated using an exploratory factor analysis (see Supplementary Methods 1; Fig. S1 and Table S1), which shown optimism to co-occur more often with movies expressing positive tone and emotions. In contrast, pessimism was orthogonal to these dimensions and co-occurred more often with movies expressing a negative tone and stress.

We z-scored all psychological variables and removed extreme outliers (with absolute z-score > 3). Then, we computed the ratios of target psychological dimensions vs. their controls (pessimism vs. optimism, negative tone vs. positive tone, and stress vs. general affect) as the difference between their z-scored values (e.g., $Z(\text{pessimism}) - Z(\text{optimism})$). We contrasted stress words with general affect, as the frequency of stress words might be modulated by general variations in emotion-related words, rather than stress-specific. We excluded movies for which the absolute ratios were higher than 3, ratio-wise.

Finally, we obtained socio-economic data from various sources: GDPpc (corrected for inflation) (Bolt and van Zanden, 2023), life expectancy (Zijdemann and Ribeira da Silva, 2023), median family income—absolute value and growth rate (corrected for inflation) (*The Mean vs. the Median of Family Income*|FRED Blog, 2015), percent of college graduates per capita (Bureau, 2023), movie revenues (corrected for inflation) (Vogel, 2010), and trust in government (Bell, 2024).

Analyses

Linear models (H1–H3). To evaluate our primary hypotheses (H1–H3), we used linear models implemented with ordinary least squares (OLS) in Python’s statsmodels package (Perktold et al., 2023). The general function and outputs can be found in section *Part 3: statistical analysis* of the general script (<https://osf.io/hncax>). Details of the model implementation can be found in Supplementary Methods 2.1.

To test H1 (DV = period + year), we compared mean levels of pessimism vs. optimism, negative vs positive tone, stress vs. affect, and ambiguity across three cinematic periods—pre-new Hollywood (1950–1966), new Hollywood (1967–1982), and post-new Hollywood (1983–2000)—controlling for year.

To test H2 (DV = period × year), we examined whether temporal slopes differed between periods, specifically assessing whether changes in psychological content accelerated or decelerated during new Hollywood relative to other periods.

For H3, we computed how psychological DVs were predicted by socio-economic predictors. Models predicting pessimism, ambiguity, negativity, and stress included each movie script, allowing us to model the contemporaneous effects of trust, movie revenues, and education while controlling for film-level variation. First, we pre-registered running full models for each psychological DV (<https://osf.io/7fr95>). (Results are depicted in Supplementary Table S2).

DV = year + GDPpc + life expectancy + median income + movie revenues + college graduates + trust in government

However, due to high collinearity between year, median income, GDP per capita, life expectancy, and college graduation rates (Supplementary Fig. S2), these variables were excluded from the final models (see Supplementary Methods 2.1 for diagnostics). Instead, for each psychological variable, we ran a baseline model1 including variables commonly cited as causes of NH (see introduction for a review) and a collinearly-corrected model2 focusing on median income *growth*.

model1: DV = movie revenues + percentage of college graduates + trust in government

model2: DV = year + movie revenues + trust in government + median income *growth*.

Temporal analysis (H4). Testing temporal precedence allows us to examine whether socio-economic changes tend to lead shifts in film-script psychology or vice versa. This distinction addresses theoretical debates on cultural production, specifically whether films primarily reflect collective moods and social realities (e.g., mood management theory) or whether they anticipate and potentially shape public sentiment. By modeling time lags, we assess whether changes in living standards and institutional trust precede changes in pessimism, ambiguity, and stress in scripts, providing indirect evidence for these competing accounts.

To test whether socio-economic shifts preceded changes in film-script psychology (H4), we implemented two complementary time-series approaches: (1) Lagged regressions (Cromwell and Terraza, 1994) and (2) ARIMA-based cross-correlations (Jebb et al., 2015). Similarly to the linear models, lag analyses focused on median income *growth* (less collinear with *year* than GDP, median income, and life expectancy) alongside trust in government and movie revenues. For transparency, we also presented the cross-correlation analysis of absolute median income.

Although psychological variables were first computed at the level of individual scripts, temporal analyses were conducted on yearly aggregates. This aggregation was necessary to align film data with socio-economic indicators (e.g., income growth, trust in government), which are only available at an annual resolution. This approach is standard in time-series analyses (Jebb et al., 2015) and in historical psychology (Atari and Henrich, 2023; Martins and Baumard, 2020), which aim to detect cultural trends across long periods rather than individual behavioral variation. Accordingly, our inferences concern historical trends at the population level rather than micro-level relationships within specific films. Complete preprocessing steps, alternative specifications, and model selection criteria are detailed in Supplementary Methods 2.2.

For lagged regressions, each psychological variable at time *t* (year) was predicted by socio-economic indicators at lags ranging from −10 to +10 years, controlling for year to capture long-term trends, and other relevant predictors such as trust in government and movie revenues. Then, we performed model selection using

the Bayesian Information Criterion (BIC), and ran it using Generalized Least Squares (Pinheiro and Bates, 2000), controlling for autocorrelations.

DV (year) = year + median income growth [year −10, year +10] + movie revenues (year) + trust in government (year)

To confirm the temporal ordering between socio-economic and psychological residuals, we detrended each series, removed autocorrelations, and assessed cross-correlations using the function `auto.arima()` from the R package `forecast` (Hyndman et al., 2024; Hyndman and Khandakar, 2008). Then, we used the function `Ccf()` (Hyndman, 2015; McMurry and Politis, 2010) to compute the highest correlation between the preprocessed psychological and socio-economic time series residuals. Due to the large number of correlations (16), we applied a false discovery ratio *p*-value correction (*adj-p*) (Benjamini and Hochberg, 1995).

Exploratory network analysis. We additionally examined the directional interrelations between socio-economic and psychological variables using a Granger-causality-based network analysis, implemented with the module `networkx` (Hagberg et al., 2008). Nodes represented variables (e.g., pessimism, ambiguity, income growth), and directed edges indicated significant predictive relationships. To identify the directional relationships between variables, we applied the function `grangercausalitytests` from `statsmodels` (Seabold and Perktold, 2010) with a maximum lag of 10 years. Technical details on network construction and validation are provided in Supplementary Methods 2.3.

Results

Socio-economic context of new Hollywood. Before testing our hypotheses, we first examined the broader socio-economic landscape of the new Hollywood (NH) period (1967–1982). As discussed in the introduction, we confirmed that NH was characterized by declining median income growth and trust in institutions relative to the pre-NH period (1950–1966), despite continued increases in absolute living standards such as GDP per capita, life expectancy, and college graduation rates (Fig. 1; Supplementary Results 1 and Table S3). Movie revenues declined most steeply in the years preceding NH, while post-NH (1983–2000) saw renewed growth in GDP, education, trust, and revenues, though life expectancy growth slowed. These socio-economic patterns provide critical context for subsequent analyses linking societal conditions to psychological trends in film scripts (H3–H4).

Psychological trends in film scripts (H1 and H2). For simplicity, we will henceforth refer to pessimism v. optimism as “Pessimism”, negative v. positive tone as “Negativity”, and stress v. general affect as “Stress”. We hypothesized that pessimism, stress, ambiguity, and negativity would be higher (H1) and grow faster (higher slopes) (H2) during NH.

As shown in Fig. 2 and Table 1, pessimism, stress, and ambiguity were higher during NH than relative to the pre-NH period, while pessimism remained elevated post-NH than during NH before declining.

Slope analyses (Table 2) revealed that pessimism and ambiguity *declined* more steeply after NH, while ambiguity *grew* more rapidly during NH compared to pre-NH. All other comparisons were non-significant. Interestingly, NH did not affect the tone (negative vs. positive) of movies.

Overall, H1 was supported for pessimism, stress, and ambiguity (but not negativity), while H2 was supported for pessimism and ambiguity. Together, these findings suggest that pessimism and ambiguity tended to be higher and grow faster in NH relative to other periods.

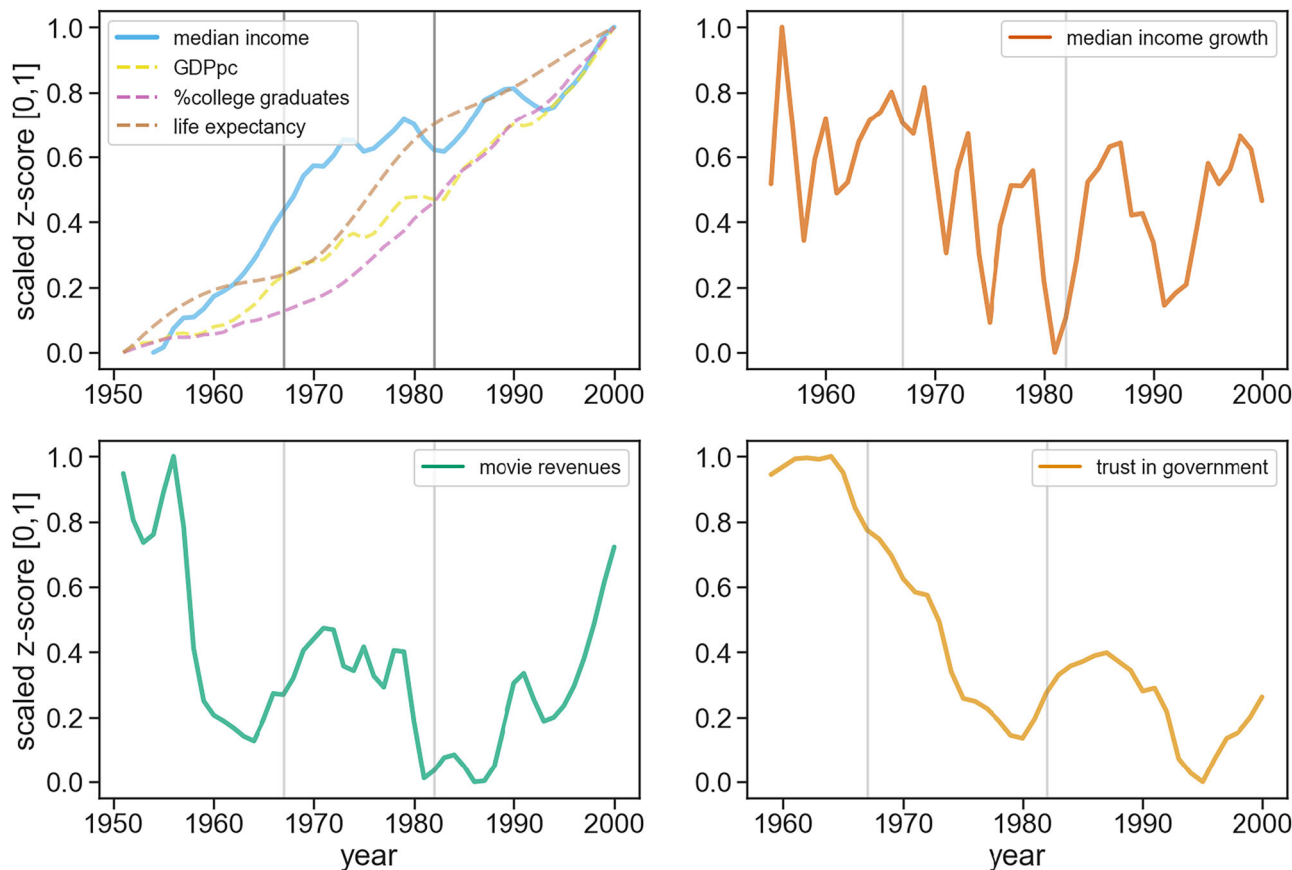


Fig. 1 Diachronic socio-economic trends between 1950 and 2000. The new Hollywood (NH) (1967–1982) period is depicted within vertical gray bars. Two-year rolled averages are depicted for all variables, and values are z-scored and scaled between 0 and 1. While absolute living standards grew during NH, income growth and trust in institutions declined. Movie revenues declined before NH.

Table 1 Psychological variables mean differences between periods.

	Pessimism	Negativity	Stress	Ambiguity
Intercept	0.044 [−0.02, 0.11]	−0.047 [−0.11, 0.02]	0.060* [−0.00, 0.12]	0.016 [−0.05, 0.08]
period[postNH]	0.125** [0.01, 0.24]	0.075 [−0.04, 0.19]	−0.015 [−0.13, 0.10]	0.107* [−0.01, 0.23]
period[preNH]	−0.476*** [−0.60, −0.35]	0.025 [−0.10, 0.15]	−0.223*** [−0.35, −0.10]	−0.317*** [−0.44, −0.19]
year	−0.173*** [−0.26, −0.09]	0.067 [−0.02, 0.15]	0.089** [0.01, 0.17]	−0.253*** [−0.34, −0.17]
Observations	5312	5408	5379	5407
Adjusted R ²	0.013	0.008	0.029	0.013
Residual std. error	0.975	0.989	0.977	0.994
F statistic	23.944***	16.091***	54.697***	24.782***

The reference group is NH (new Hollywood). 95% CI are shown within squared parentheses. Coefficients relevant to the tested hypotheses are shown in bold.
*p < 0.1; **p < 0.05; ***p < 0.01.

Socio-economic predictors of psychological trends (H3). We hypothesized that declines in living standards, proxied by median income growth (see Supplementary Methods 2.1 and Supplementary Results 2), would predict increased pessimism, ambiguity, negativity, and stress in film scripts, when controlling for college education, trust in institutions, and movie revenues—the variables more often cited as leading to NH (see introduction).

First, we computed a baseline model (Table 3) with movie revenues, trust, and college education. We confirmed that the decline in movie revenues predicted pessimism and ambiguity, and the decline in trust predicted pessimism, stress, and

ambiguity. Against our expectations, the rise in college education predicted less pessimism and ambiguity, but also more negativity.

Then, we tested the effects of median income growth, when accounting for the baseline model and long-term trends (year) (college education was excluded due to high collinearities with year). We found that despite correlating negatively with pessimism, negativity, and stress (Fig. 3), the effects of income growth were not significant when controlling for trust and movie revenues (Table 4).

This suggests that while there was some evidence supporting H3, it was not robust to the introduction of relevant covariates.

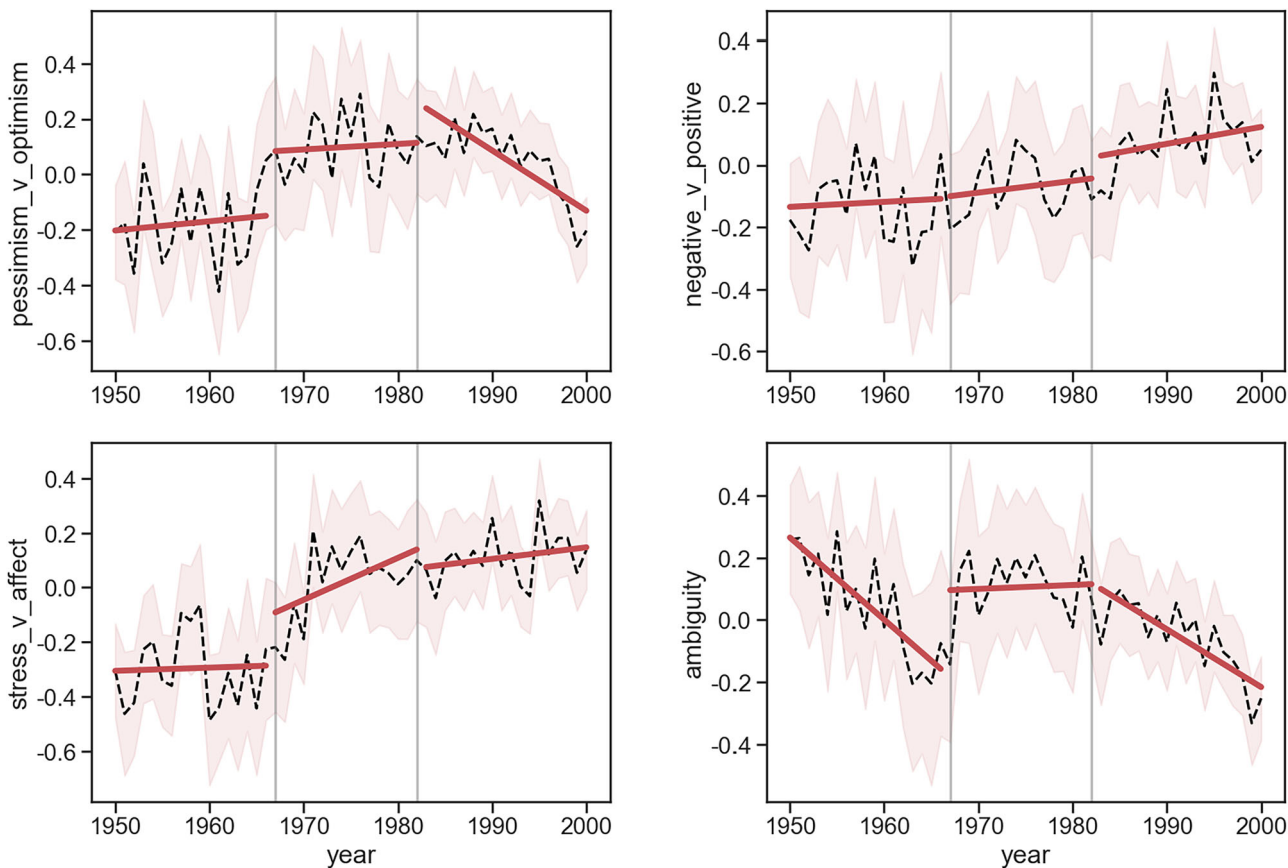


Fig. 2 Movie script variations in the expression of pessimism vs. optimism, negative vs. positive tone, stress vs. general affect, and ambiguity. Dashed black lines represent the rolling 2-year averages of psychological measures. Solid red lines represent regression slopes for each period: pre-NH (1950–1966), NH (1967–1982), and post-NH (1983–2000). Ninety-five percent confidence intervals are contained within the red bands. Pessimism, stress, and ambiguity were higher during NH than pre-NH; pessimism and ambiguity also declined faster after NH.

Table 2 Psychological variables slope differences between periods.

	Pessimism	Negativity	Stress	Ambiguity
Intercept	0.120*** [0.03, 0.21]	−0.050 [−0.14, 0.04]	0.113** [0.03, 0.20]	0.113** [0.03, 0.20]
period[postNH]	0.178*** [0.05, 0.31]	0.063 [−0.07, 0.19]	−0.049 [−0.18, 0.08]	0.038 [−0.09, 0.17]
period[postNH]:year	−0.380*** [−0.60, −0.16]	0.028 [−0.19, 0.25]	−0.173 [−0.39, 0.04]	−0.306*** [−0.53, −0.09]
period[preNH]	−0.211 [−0.49, 0.07]	−0.036 [−0.32, 0.25]	−0.383*** [−0.67, −0.10]	−0.646*** [−0.93, −0.36]
period[preNH]:year	0.010 [−0.25, 0.27]	−0.034 [−0.29, 0.23]	−0.220* [−0.48, 0.04]	−0.427*** [−0.69, −0.17]
Year	0.044 [−0.14, 0.23]	0.059 [−0.13, 0.25]	0.238** [0.05, 0.42]	0.020 [−0.17, 0.21]
Observations	5312	5408	5379	5407
Adjusted R ²	0.016	0.008	0.029	0.015
Residual std. error	0.973	0.989	0.977	0.993
F statistic	18.438***	9.720***	33.480***	17.149***

The reference group is NH (new Hollywood). 95% CI are shown within squared parentheses. Coefficients relevant to the tested hypotheses are shown in bold.
p* < 0.1; *p* < 0.05; ****p* < 0.01.

We further explored whether the socio-economic variables partially mediated the psychological differences between NH and other periods. Mediation analyses (Supplementary Tables S4–S6) suggested that lower trust partially mediated the period differences in Pessimism [NH-preNH: $\beta = -0.07$, 95% CI [−0.13, −0.01], $p = 0.02$; NH-postNH: $\beta = -0.10$, 95% CI [−0.18, −0.02],

$p = 0.02$], while movie revenues showed a weaker, non-significant trend [NH-preNH: $\beta = 0.08$, 95% CI [0.00, 0.16], $p = 0.053$; NH-postNH: $\beta = -0.04$, 95% CI [−0.08, 0.00], $p = 0.052$]. Median income growth did not mediate these differences.

Trust also partially mediated the period differences in Stress [NH-preNH: $\beta = -0.06$, 95% CI [−0.12, 0.00], $p = 0.06$;

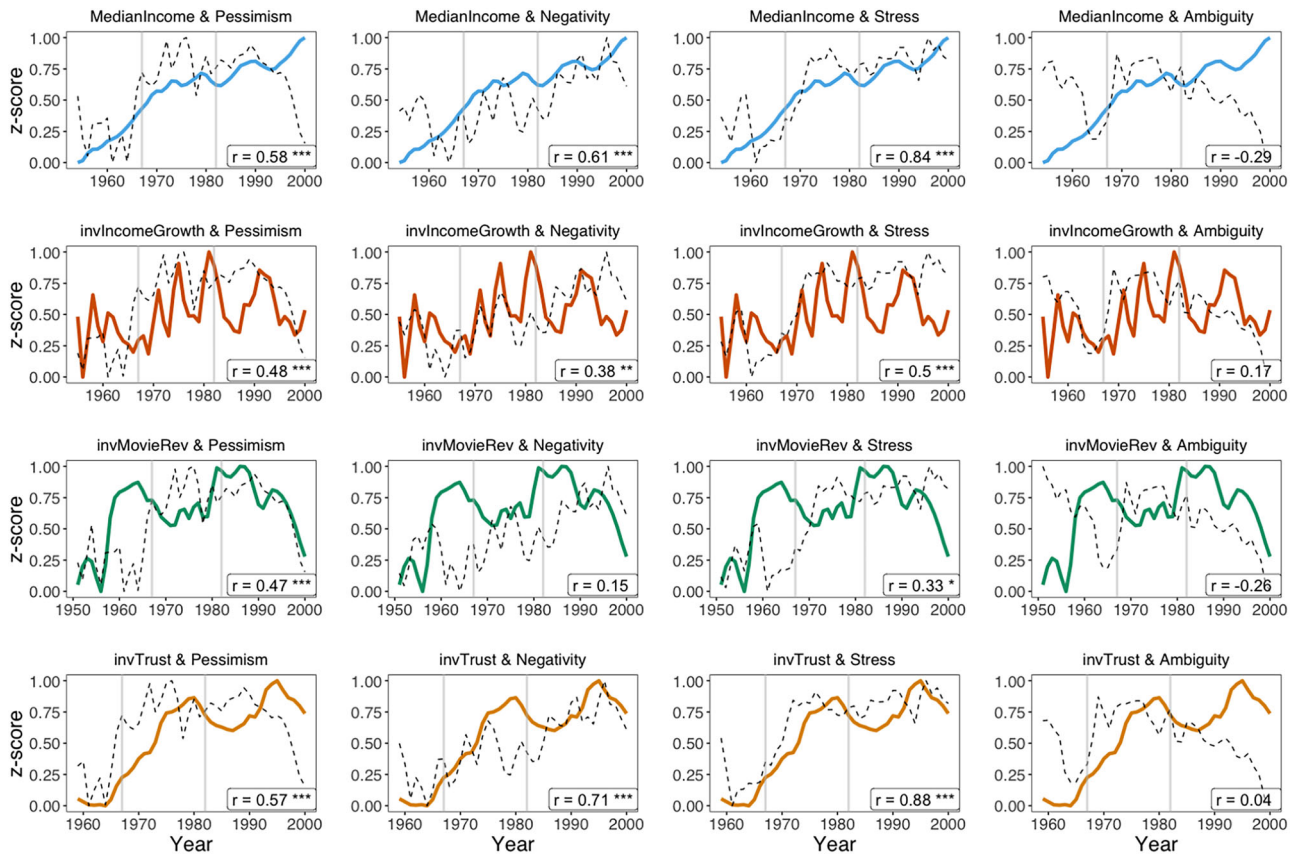


Fig. 3 Temporal variations of psychological and socio-economic variables. Psychological variables (columns from left to right: pessimism, negativity, stress, and ambiguity) are depicted as dashed black lines. Non-collinear socio-economic variables (see “Methods” for explanation) are shown as solid-colored lines: median income (blue), inverted income growth (red), inverted movie revenues (green), and inverted trust in institutions (orange). We show an inverted time series of income growth (invIncomeGrowth), movie revenues (invMovRev), and trust (invTrust) to highlight their negative correlation with the psychological variables. The correlation values shown pertain to the *yearly averages* of the time series (rolling 2-year average). Interestingly, while median income correlates with *more* pessimism, negativity, and stress, median income *growth* is *negatively* correlated with these variables. All values are z-scored and scaled between 0 and 1. Vertical gray lines bound the period of new Hollywood (1967–1982). * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3 Baseline model of socio-economic impacts on psychological variables.

	Pessimism	Negativity	Stress	Ambiguity
Intercept	-0.050** [-0.28, -0.09]	0.019 [0.04, 0.23]	0.073*** [-0.05, 0.14]	-0.081*** [-0.38, -0.18]
College	-0.186*** [-0.10, -0.00]	0.135*** [-0.03, 0.07]	0.043 [0.03, 0.12]	-0.277*** [-0.13, -0.03]
MovieRev	-0.132*** [-0.20, -0.06]	-0.024 [-0.10, 0.05]	0.020 [-0.05, 0.09]	-0.072* [-0.14, 0.00]
Trust	-0.150*** [-0.20, -0.10]	-0.037 [-0.09, 0.02]	-0.133*** [-0.19, -0.08]	-0.102*** [-0.16, -0.05]
Observations	4590	4671	4642	4672
Adjusted R ²	0.011	0.008	0.017	0.010
Residual std. error	0.972	0.976	0.984	0.988
F statistic	18.101***	13.149***	27.053***	17.375***

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
College: yearly % of college graduates US (Bureau, 2023); **MovieRev**: yearly Movie Revenues US corrected for inflation; **Trust**: yearly Trust in the government (Bell, 2024). 95% CI are shown within squared parentheses. Coefficients relevant to the tested hypotheses are shown in bold.

NH-postNH: $\beta = -0.08$, 95% CI [-0.17, 0.00], $p = 0.06$, though the effect was not significant. Finally, no mediation was observed for ambiguity.

These results again confirm the relationship between distrust in institutions and the Pessimistic tone during NH. However, given the low explained variance ($R^2 = 0.014$), these findings should be interpreted cautiously.

Temporal precedence analyses (H4). We hypothesized that changes in socio-economic conditions (focusing on income growth) would precede shifts in pessimism (<https://osf.io/7fr95>). To assess these relationships, psychological variables were aggregated by year.

Lagged regression analyses with model selection showed that declines in income growth predicted later increases in pessimism (best time lag was 9 years, Table 5). Crucially, this analysis controlled for the effects of long-term trends (year), movie revenues, and trust in institutions (also college education, Supplementary Table S7). Cross-correlation analyses using detrended and pre-whitened time series supported this finding: lower income growth preceded higher pessimism [$lag = -5$, $maxCCF = -0.38$, $adj-p = 0.029$] (Fig. 4 and Supplementary Table S8).

Table 4 Model with living standards (median income growth).

	Pessimism	Negativity	Stress	Ambiguity
IncomeGrowth	-0.007 [-0.04, 0.03]	-0.014 [-0.05, 0.02]	-0.005 [-0.04, 0.03]	-0.006 [-0.04, 0.03]
Intercept	-0.010 [-0.07, 0.05]	-0.016 [-0.08, 0.04]	0.057* [-0.00, 0.12]	-0.010 [-0.07, 0.05]
MovieRev	-0.142*** [-0.21, -0.07]	-0.017 [-0.09, 0.05]	0.019 [-0.05, 0.09]	-0.079** [-0.15, -0.01]
Trust	-0.149*** [-0.21, -0.08]	-0.020 [-0.08, 0.04]	-0.119*** [-0.18, -0.05]	-0.119*** [-0.18, -0.05]
year	-0.108*** [-0.18, -0.04]	0.094*** [0.03, 0.16]	0.040 [-0.03, 0.11]	-0.184*** [-0.25, -0.11]
Observations	4590	4671	4642	4672
Adjusted R ²	0.010	0.007	0.016	0.009
Residual std. error	0.973	0.976	0.984	0.988
F statistic	12.468***	9.775***	20.420***	12.112***

*p < 0.1; **p < 0.05; ***p < 0.01.

MovieRev: yearly Movie revenues US corrected for inflation (Vogel, 2010); **IncomeGrowth:** yearly Median Family Income growth US (The mean vs. the Median of Family Income | FRED Blog, 2015); **Trust:** yearly Trust in the government (Bell, 2024). 95% CI are shown within squared parentheses. Coefficients relevant to the tested hypotheses are shown in bold.

Table 5 Lagged regression for income growth, controlling for trust and movie revenues.

	Pessimism	Negativity	Stress	Ambiguity
Year	-0.738 [-2.25, 0.78]	1.262*** [0.31, 2.21]	1.769** [0.27, 3.26]	-1.461** [-2.58, -0.35]
Movie revenues	-0.702 [-1.67, 0.27]	-0.056 [-0.79, 0.68]	-0.070 [-0.67, 0.53]	-0.201 [-0.10, 0.59]
Trust	-0.508 [-1.25, 0.23]	-0.234 [-0.78, 0.31]	0.097 [-0.38, 0.57]	-0.661** [-1.26, -0.06]
Income growth T-9	-0.236** [-0.45, -0.02]			
Income growth T + 5				-0.280** [-0.49, -0.07]
Intercept	-0.353 [-1.39, 0.68]	-0.539 [-1.19, 0.12]	-1.004 [-2.21, 0.20]	0.191 [-0.58, 0.96]
Observations	37	37	37	37
Log likelihood	-33.244	-28.122	-14.433	-27.441
Akaike inf. crit.	80.488	68.245	40.866	68.883
Bayesian inf. crit.	91.764	77.910	50.531	80.159

95% CI are shown within squared parentheses. Coefficients relevant to the tested hypotheses are shown in bold.

*p < 0.1; **p < 0.05; ***p < 0.01.

Exploring the lagged regression with the other psychological variables (Supplementary Table S7), we found that rising Ambiguity preceded a drop in income by 5 years [$\beta = -0.280$, 95% CI [-0.389, -0.171], $p < 0.05$], a result also supported by the cross correlation analysis [$lag = 6$, $maxCCF = -0.38$, $adj-p = 0.029$](Supplementary Table S8). Lagged regressions revealed no clear precedence between income growth and stress and negativity.

Beyond the main finding that declining income growth preceded rising pessimism, we observed additional temporal patterns in the cross-correlations that suggest complex relationships between psychological and socio-economic variables. Higher movie revenues predicted less stress, and higher trust predicted a drop in ambiguity (Fig. 4 and Supplementary Table S8). Conversely, several reciprocal effects emerged, such as higher pessimism preceding lower trust and revenues, and higher Stress preceding lower trust.

Network analysis. Due to the complex interplay among variables, we conducted an exploratory Granger-causality-based network analysis (Fig. 5). We found that stress, negativity, trust, median income, and college education formed the network’s core

(Supplementary Table S9) and had the highest centrality values (degree = 0.88; eigenvector = 0.41–0.46).

Most relationships were bidirectional, reflecting the overall correlation structure. At the network’s core, Trust correlated with lower stress, negativity, and college education. Conversely, median income and college education correlated with higher stress and negativity. Median income and income growth were negatively correlated, which is explained by the continuous rise of absolute median income despite declining growth rates.

Crucially, some unidirectional pathways emerged. In line with the results above, declining income growth appeared to precede higher pessimism and lower trust, while pessimism predicted increases in stress and ambiguity. Finally, college education predicted higher median income, and negativity predicted higher pessimism. These feedback loops highlight the reciprocal dynamics between socio-economic conditions and film-script psychology (Supplementary Table S10).

Overall, we found converging evidence—from lagged regressions, cross-correlations, and network analysis—that declines in income growth preceded increases in pessimism in film scripts. This supports H4. However, similar precedence patterns were not observed consistently for stress, ambiguity, or negativity,

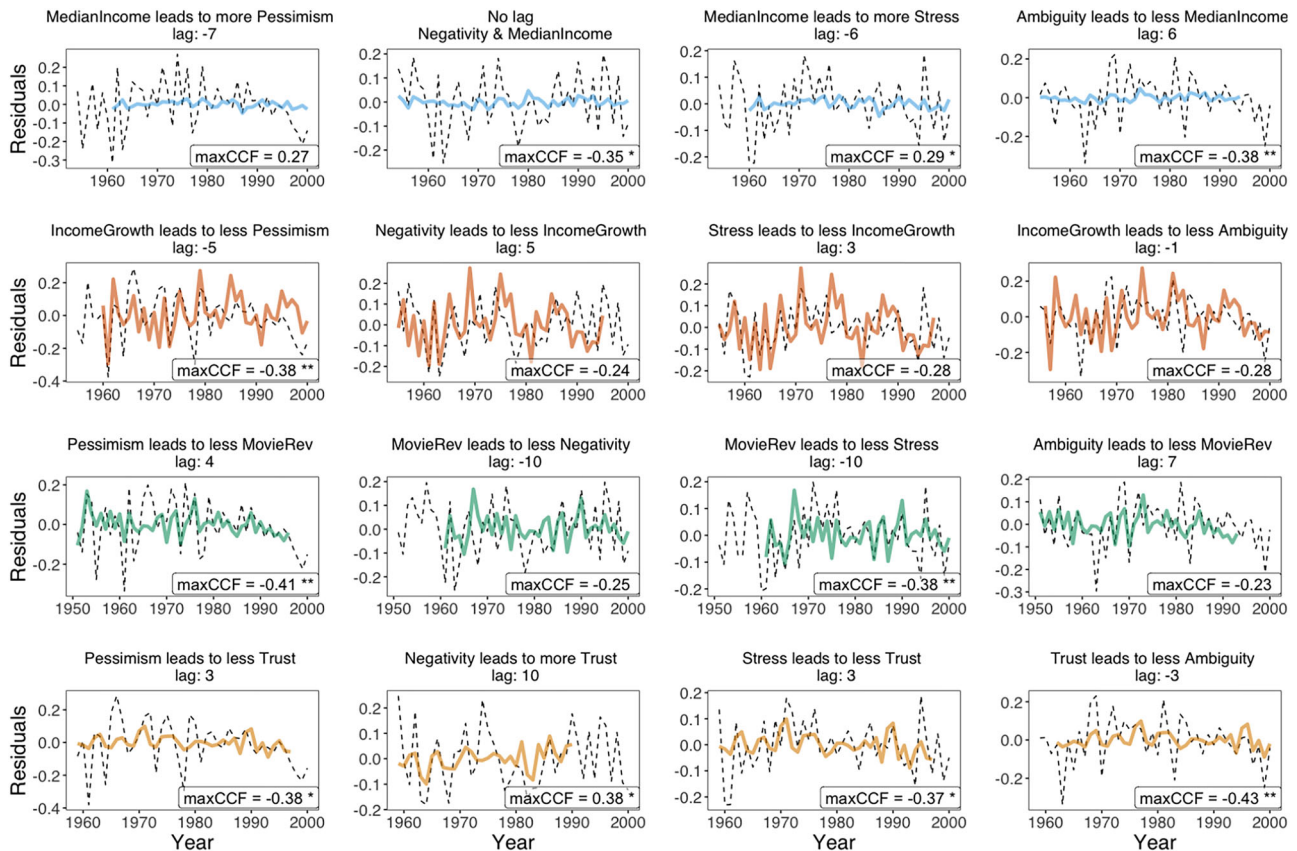


Fig. 4 Cross-correlations between psychological and socio-economic variables. Psychological variables (columns from left to right: pessimism, negativity, stress, and ambiguity) are depicted as dashed black lines. Socio-economic variables are shown as solid-colored lines: median income (blue), income growth (red), movie revenues (green), and trust in institutions (orange). All variables are detrended and pre-whitened (i.e., autocorrelations are removed). The socio-economic time series are shifted along the x-axis, fitting the best time lag (Supplementary Table S8), and they are inverted when the correlation between variables is negative. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 6 Summary of hypotheses and key results.

	Analysis	Key findings	Supported?
H1: Psychological variables (Pessimism, Stress, Ambiguity, Negativity) are higher during NH than other periods.	Linear models period + year	Pessimism, stress, and ambiguity were higher during NH vs. pre-NH; negativity unaffected by NH boundaries.	Partially supported (all except negativity)
H2: Psychological slopes differ between periods (NH vs. pre- and post-NH).	Linear models period × year	Pessimism and ambiguity declined faster after NH; ambiguity rose faster during NH than preNH;	Partially supported (for pessimism and ambiguity)
H3: Living standards predict psychological variables when accounting for trust, movie revenues, and college	Linear models; exploratory mediation analyses.	Trust and movie revenues predicted pessimism and ambiguity; income growth effects were not robust; trust partially mediated pessimism differences across periods.	Not supported (though declining trust was a robust predictor of rising pessimism in NH)
H4: Changes in living standards precede changes in psychological variables, when accounting for trust, movie revenues, and college	Lagged regressions; cross-correlations; exploratory network analysis.	Declining income growth consistently preceded increases in pessimism; no consistent precedence found for other psychological variables.	Partially supported (pessimism only)

underscoring the complex and often reciprocal dynamics between socio-economic trends and cultural expression in movies.

A general overview of all results is presented in Table 6.

Discussion

This study examined how socio-economic dynamics shaped the psychological tone of American cinema during the new Hollywood (NH) era (1967–1982) by analyzing ~6000 film scripts from 1950–2000 using natural language processing (NLP) and

historical psychological methods. We found that pessimism, stress, and ambiguity rose during NH and declined afterward, while negativity increased steadily across the entire period. Trust in institutions and movie revenues were the strongest contemporary predictors of pessimism and ambiguity, whereas income growth showed little effect in contemporaneous models but reliably predicted later increases in pessimism in lagged analyses. These findings point to delayed cultural responses to economic downturns. Finally, exploratory analyses further

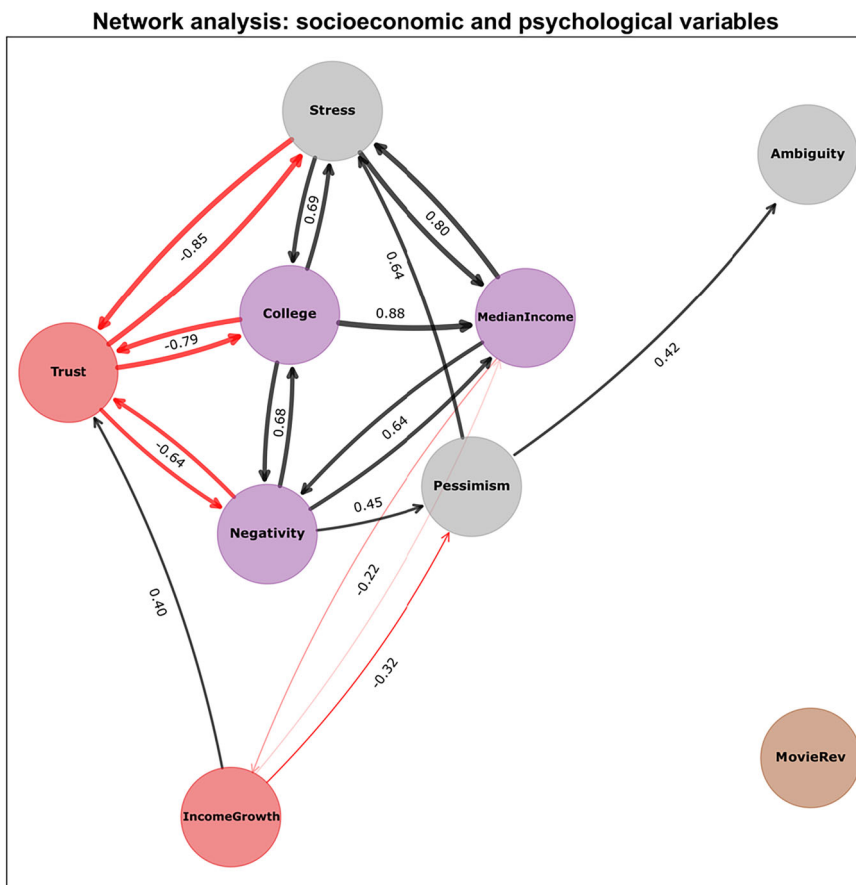


Fig. 5 Variable network analyses. We constructed a directed graph with nodes representing the variables and directed edges indicating the significant Granger causality relationships. Two directed edges were drawn when bidirectional causality was present. Black arrows represented positive correlations, while red arrows depicted negative correlations. The line thickness and value labels represent mean edge weights obtained using a bootstrap resampling procedure (Table S10 and Fig. S3).

revealed reciprocal feedback loops, underscoring the complex interplay between societal conditions and cultural narratives.

NLP analysis of movie scripts captured the NH social zeitgeist (H1 and H2). First, we found that pessimism, stress, and ambiguity were elevated during NH relative to pre-NH, and pessimism and ambiguity declined more steeply in the post-NH era. By contrast, negativity showed no clear relationship to NH boundaries.

This supports accounts of NH as a period defined by moral ambiguity and disillusionment (Abrams and Frame, 2021; Lehmann, 2013), exemplified by films like *The Godfather* and *Taxi Driver* that rejected heroic archetypes and instead portrayed antiheroes confronting personal and societal crises. This thematic turn might have resonated with audiences navigating widespread societal tensions, including the Vietnam War and Watergate scandal, which fuelled growing distrust in institutions (Bachman and Jennings, 1975; Krämer, 2005; Schudson, 2004).

Notably, NH tone was more ambiguous and pessimistic but not more negative, thus focusing on uncertainty. This aligns with mood- and domain-congruence theories of media consumption, where audiences seek narratives that mirror their psychological states and offer cognitive rehearsal or cathartic relief during periods of social upheaval (Knobloch-Westerwick, 2006; Luong and Knobloch-Westerwick, 2021; Strizhakova and Krcmar, 2007).

Interestingly, the decline in pessimism and ambiguity after NH coincided with a broader industrial realignment in Hollywood. As studios identified commercially successful formulas during NH—

particularly high-concept blockbusters with clearer moral structures and resolution—they increasingly replicated these approaches from the 1980s on (Gitlin, 2003; Schatz, 2011).

Institutional and market predictors of pessimism and ambiguity (baseline). Rising college education, declining movie revenues, and distrust in institutions have often been cited as drivers of pessimism and ambiguity in NH (Abrams and Frame, 2021; Hunter, 2016; Lehmann, 2013; Snibbe and Markus, 2005).

As we have shown, movie revenues declined before NH, while the number of college graduates and distrust in institutions *accelerated* during NH. Interestingly, declining movie revenues and distrust partially mediated the rising pessimism during NH relative to other periods. However, to determine whether these variables could have a causal effect, we analysed their dynamics beyond NH with a baseline model. We also assessed their temporal relation to the psychological variables. Our findings suggest that while education, trust, and movie revenues correlated with pessimism and ambiguity, their causal role could not be established.

First, college education correlated with *increasing* negativity and stress and *declining* pessimism and ambiguity, with no preferential directionality. Its rise during and after NH—when pessimism and ambiguity declined—contradicts claims that more educated societies prefer pessimistic or ambiguous narratives (Snibbe and Markus, 2005). However, it may explain the steady increase in negativity.

Second, trust in institutions showed a different pattern: rather than predicting pessimism, its temporal variation largely *followed* it. Although declining trust preceded rising ambiguity at certain lags, network analyses suggest these dynamics may be secondary to income growth (Margalit, 2019). Historical shocks, including Watergate and the Vietnam War, might have eroded social capital and modulated the relationship between trust, pessimism, and ambiguity (Guiso et al., 2011; Keele, 2007).

Finally, the effects of movie revenues are similarly complex. Before NH, rising pessimism lagged declines in revenues by roughly a decade, but after NH, the two series tracked more closely. This may reflect studios' growing ability to anticipate profitable themes and pivot toward high-concept blockbusters in the 1980s after their slow response to the revenue shocks that preceded NH (Gomery, 2005; Hunter, 2016; Monaco, 2001). Notably, cross-correlation analyses also revealed that pessimism in scripts often preceded subsequent declines in revenues, hinting at a feedback loop where darker content initially aligned with audience moods but, over time, led to declining box office performance.

Living standards and lagged cultural responses (H3 and H4).

Beyond the baseline model, we examined whether living standards—proxied by median income *growth*—shaped cultural preferences. Two opposing mechanisms were plausible: On the one hand, worsening material conditions can lead to a cultural expression of anxiety, negativity, moral ambiguity, and pessimism (Hao et al., 2022; Haushofer and Fehr, 2014; Molotsky and Handa, 2021; Yoshikawa et al., 2012). Conversely, high living standards and a more sophisticated audience might demand more nuanced and complex topics (Dubourg et al., 2023; Hershfield and Alter, 2019).

Our strongest result was that declines in income *growth* reliably preceded increases in pessimism by 5–9 years. This lagged effect remained significant after controlling for trust, revenues, and college education. Our data also suggests that income growth predicts and temporarily precedes the level of trust in institutions, consistent with economic literature on economic shocks (Margalit, 2019). This lagged effect highlights that socio-economic conditions can shape cultural outputs over time, with a period of adjustment between material conditions and their representation in creative works.

However, absolute living standards, such as median income, life expectancy, and GDPpc, *rose* throughout 1950–2000, including during NH, when pessimism and ambiguity *increased*. This paradox suggests dual dynamics: In the long run, the rise of living standards and education may create preferences for more complex, heavy, and nuanced material (Dubourg et al., 2023; Hershfield and Alter, 2019). When in *stable* emotional dispositions, audiences are more likely to handle the temporary discomfort of negative media in exchange for gaining insights or experiencing narratives with deeper emotional resonance or eudaimonic gratification (Reinecke and Meier, 2021; Stevens and Dillman Carpentier, 2017). Conversely, social comparison, self-evaluation, and catharsis may gain importance in periods of instability, such as economic and institutional shocks, leading audiences to prefer ambiguous and pessimistic themes (Knobloch-Westerwick, 2006; Luong and Knobloch-Westerwick, 2021).

Mechanisms: linking socio-economic change, institutional trust, and cultural pessimism. Our findings point to dual mechanisms—bottom-up and top-down—linking socio-economic and institutional change to the pessimistic and ambiguous tone of NH films.

Bottom-up dynamics align with mood-management theory (Bower, 1981; Knobloch-Westerwick, 2006; Luong and Knobloch-Westerwick, 2021; Reinecke and Meier, 2021; Stevens and Dillman Carpentier, 2017; Strizhakova and Krcmar, 2007; Zillmann, 1988): slowing income growth and declining trust likely fueled collective anxiety, prompting audiences to seek morally complex narratives. NH directors, many trained in film schools, might have tapped into these moods for critique and catharsis (Hunter, 2016; Lehmann, 2013). The lag between income growth and pessimism supports this delayed cultural response.

Top-down dynamics reflect industry incentives. Theories like Herman and Chomsky's propaganda model (Herman and Chomsky, 1988) and Gitlin's framing work (Gitlin, 2003) highlight how corporate consolidation and advertiser pressures shape narratives. During NH, box office declines prompted experimentation with anti-establishment themes, but once blockbusters like *Star Wars* and *Jaws* proved profitable, studios shifted toward replicable formulas—paving the way for the 1980s franchise era (McChesney, 2016; Schatz, 2011).

These dynamics likely reinforced each other: economic stagnation might have primed audiences for darker content, while studios amplified it until profitability drove a pivot toward franchise blockbusters. Our reciprocal findings between pessimism and movie revenues support these complex dynamics.

Contributions and future directions. This study contributes to film studies, historical psychology, and cultural analysis in several ways. Methodologically, it demonstrates how natural language processing (NLP) can quantify the psychological and emotional tone of cinema over five decades, providing a scalable approach for tracking cultural shifts. Substantively, it offers empirical evidence linking socio-economic dynamics—particularly income growth and institutional trust—to changes in pessimism and ambiguity in NH films. By showing both contemporary correlations and lagged relationships, it highlights how cultural expression may respond to economic downturns with a delay, mediated by shifts in audience mood and industry strategy.

Future research can explore additional psychological dimensions and historical periods, providing deeper insights into how filmmakers navigate the complex socio-political landscape of their times. An exciting extension of this work would be to draw parallels between the decline of the Western genre in the late 1960s and the potential downturn of the superhero genre in contemporary cinema. Both genres faced periods of audience fatigue and declining appeal, making this a valuable comparison for understanding cyclical patterns in film history (Hughes, 2024).

Limitations. This study has several limitations that should be considered when interpreting the findings. First, although NLP tools, such as LIWC are widely used in sentiment and word frequency analysis, they may not fully capture the complexity of emotional and psychological expression in films. LIWC focuses on individual words and thus overlooks contextual elements, such as sentence context, tone, delivery, or visual and musical cues that also shape meaning.

Second, our dataset was imbalanced, with more films available from later decades. While we controlled for time trends in our analyses, this imbalance may still affect the robustness of some estimates.

Third, the study's observational design limits causal inference. Temporal precedence does not imply causation; unmeasured variables (e.g., major historical events like Watergate or the Vietnam War) may underlie observed associations. Relatedly,

psychological measures were aggregated at the yearly level in temporal analyses to align with socio-economic data, following standard practice in historical psychology and historical economics (Atari and Henrich, 2023; M. de J. D. Martins and Baumard, 2020). This means our findings address broad cultural dynamics rather than micro-level processes, such as individual filmmakers' intentions or audience reception. Future work could examine how socio-economic trends affect different audience segments (e.g., by education or expertise) to understand better how cultural products are perceived and interpreted across groups.

Conclusion

This study fills a critical gap in understanding how socio-economic trends influenced movies' emotional tone and psychological complexity during NH. By linking cultural expression to material conditions, we have provided a framework for understanding the dynamic nature of cinema's responsiveness to external societal pressures. The tools and methods we employed—particularly NLP and word frequency analysis—offer a replicable model for future studies exploring similar dynamics in other periods or genres. Ultimately, this research deepens our understanding of NH and sets the stage for future explorations into the intersection of socio-economics, psychology, and film.

Data availability

The datasets analyzed in this study—including the processed movie scripts, derived textual features, and all analysis and visualization scripts—are publicly available via the open science framework (OSF) repository at: https://osf.io/kndb4/?view_only=79a1b63f9e2d436f9f1f5fc60ee8655a. The repository provides all data and custom code necessary to reproduce the analyses reported in the manuscript. Raw movie scripts were sourced from publicly available online repositories. Where redistribution of original scripts is restricted, the OSF repository provides derived datasets and documentation sufficient to reproduce all reported analyses.

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Author contributions

DR and MM designed the study, conducted the analysis, and wrote the main manuscript text; MM and CL supervised the study, and all authors reviewed the manuscript.

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Competing interests

The authors declare no competing interests.

Ethical approval

This study did not involve human participants, animals, or the collection of personal data. All analyses were conducted exclusively on publicly available movie scripts and related textual materials obtained from open online repositories. These materials are cultural artifacts intended for public dissemination and do not contain private, identifiable, or sensitive information. Accordingly, the study does not constitute human subjects research, and ethical approval was not required under applicable institutional, national, or international regulations. All research procedures were conducted in accordance with relevant ethical guidelines governing research integrity and data use (e.g., Declaration of Helsinki; EU General Data Protection Regulation, Recital 26).

Informed consent

Informed consent was not obtained because the study did not involve human participants or personal data. The analyzed materials consist solely of publicly available media texts, accessed without any interaction with individuals and without any reasonable expectation of privacy. As such, informed consent was neither applicable nor required under applicable ethical and legal standards.


Additional information

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