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Finally! How time lapse in Nobel Prize reception affects emotionality in the Nobel Prize banquet speeches

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Abstract
We have a limited understanding of the role emotions play in academia, as exploring emotions consistently and comparably is challenging due to the powerful influence of contextual factors. However, we have identified an interesting setting to empirically investigate the emotional response in academia by examining Nobel Prize winners. Scientists who aspire to earn a Nobel Prize are under pressure from their environment if they have not yet received the Prize. While there are various indicators that suggest the Nobel Prize is forthcoming, the question of "when" weighs heavily on the minds of leading candidates. Consequently, waiting for the Nobel Prize is emotionally taxing. We therefore hypothesize that Nobel laureates who have experienced a prolonged wait for the award would feel a stronger sense of relief upon receiving it. We are interested in measuring their level of emotionality after receiving the Nobel Prize by analyzing their banquet speeches using linguistic content analysis. Banquet speeches provide a consistent and controlled setting to compare emotionality across scientists and over time, as we can measure the same responses to the same recognition under the same circumstances. We expect that waiting longer for the Nobel Prize will increase the positive emotionality of Nobelists' speeches. The waiting time is determined by calculating the years since the Nobel Prize-winning work was performed. By conducting this time-lapse study, we find a robust positive correlation between waiting time and positive emotions in Nobel Prize banquet speeches. We conclude that scientists who waited longer for the Nobel Prize reported higher levels of positive emotions during their speeches.

Keywords Nobel laureates · Emotions · Nobel Banquet speech · Recognition · Awards · Nobel Prize Winners · Waiting Time

> *I am one of the very fortunate scientists who have achieved what many claim to be the ultimate form of recognition or even the ultimate form of happiness in this exuberant, splendid, almost unearthly setting.*
> *Richard Ernst, in his 1991 Nobel Prize banquet speech*

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Since the early 1980s, I had thought there was a realistic possibility that I'd get the Nobel Prize. Our work was clearly very important for physics, and by then accurate experiments had confirmed it. So each October, around the announcement time, I had a very difficult time sleeping. 2004 was no exception, and I really didn't sleep at all on the night of October 4. At 5:12 a.m. I was in the middle of my intended shower, when my wife came in with our telephone in hand. I hadn't heard any ringing, because of [the] noise of the water. She said, 'There's a woman with a beautiful voice calling from Sweden for you.' I got out of the stall, naked and dripping wet, to take the call. It was the Nobel Prize.

Nobel laureate Frank Wilczek cited by Carolyn Johnston (2013)

If ever I to the moment shall say: Beautiful moment, do not pass away! Then you may forge your chains to bind me.

Goethe's Faust, lines 1698–1706.

Introduction

This study delves into the intriguing relationship between delayed gratification and emotional response in the context of the prestigious Nobel Prize. Specifically, we explore the duration of time between a scientist's accomplishment of Nobel Prize-worthy work and the moment when they are finally bestowed with the coveted prize. By analyzing the positive emotional content of their Nobel Prize-winning banquet speeches, we aim to uncover whether receiving the award provides a sense of relief. Our hypothesis posits that the longer the wait, the more emotionally positive the speech will be. We also investigate the influence of personality traits on the degree of positive emotions experienced, in relation to the elapsed time between the Nobel Prize-worthy work and the actual Prize. By conducting a thorough analysis, we aim to provide valuable insights into the complex interplay between delayed gratification and emotional response, as experienced by those who have reached the pinnacle of scientific achievement.

Despite evident links between emotion and reason, the sharp line traditionally drawn between the two still prevails in the scientific world. For example, the expression of scientific thought is normally isolated from any expression of emotion. In fact, Gergen (1999) claims that scientists see no place for passion and emotion in science because they lead to biases. They thus try to live up to the expectation that their conceptual environment is clean and their cognition is 'uncontaminated' by emotion. The result is a frequently unquestioned assumption that science is value-free and detached (Maslow, 1966). Yet it is unclear whether scientists actually succeed in suppressing their emotions in their writings, speeches or acting in general, not least because they are so passionate about their work as to enjoy communicating it and being acknowledged for their efforts greatly. Hence, even though scientists may try to keep their temperaments within bounds, they are unlikely to avoid injecting something of themselves into their work (Watson, 1953). Moreover, as Barbalet (2004) notes, "emotions are not only central to the sustaining framework of science but also necessary in its core activities" (p. 270). More importantly, scientists may have expectations and hopes for how their peers evaluate their work, and those expectations are not free of emotional responses. Thus, it is a natural avenue, as done in this study, to explore the Nobel Prize, which is seen as the "supreme symbol of accomplishment in science" (Harriet Zuckerman, 1996, xiii) and the most esteemed scholarly award both inside and outside the scientific arena. It brings with it, as John Polanyi, Nobel laureate and son of Michael Polanyi commented to Douglas Quan (2015), membership to an exclusive club and "a twinge of insecurity and the 'chaos

of brief celebrity'".[1] Similarly, Tim Hunt, the British biochemist and Nobelist, speaking to Douglas Quan about how important such an award is, noted: "I found it pretty hard to bear at first, and was extremely nervous that the Swedes would realize their mistake and rescind the prize at the last minute". And Nobel laureate Paul Samuelson (2004, p. 60) stresses that "[s]cientists are as avaricious and competitive as Smithian businessmen. The coin they seek is not apples, nuts, and yachts; nor is it the coin itself, or power as that term is ordinarily used. Scholars seek fame. The fame they seek … is fame with their peers—the other scientists whom they respect and whose respect they strive for".

There is substantial anecdotal evidence about the pressures and hopes around the Nobel Prize. Zuckerman (1996, pp. 209–210), for example, recounts the following story about a disappointed scientist by a Nobel laureate biochemist[2]: "[Baker, a pseudonym] was just over seventy when I went to his laboratory. A whole group went to his home, and Mrs. Baker showed us all of his medals, and there was something she said that made me realize that she was disappointed. It was undoubtedly a reflection of her husband's own feelings of disappointment that he had not been recognized by a Nobel award. Driving home with my wife, we got to talking about this and I said, 'I am never going to worry or have a goal in mind of any prize, even a Nobel award. I refuse to die disappointed if I don't get it'. You put your happiness into the hands of some committee, which can be capricious. You've got to work for the fun of it. Men of equal accomplishment don't get it and then they have to rationalize for the rest of their lives. But don't get me wrong, I'm not sorry I got it". Potential Nobelist candidates can be pressured by their colleagues and the public. Gary Becker (2004, p. 268), for example, referred to the mounting pressure in the late 1980s when his name "was so often mentioned as a leading candidate. A betting pool organized by some American economists had me listed as their favourite (i.e., the lowest odds person) for three or four years running before I got the Prize. And so individuals and reporters had begun asking me with some regularity: 'When will you get the prize?' or, once the Prize was announced each year, 'Why didn't you get it this year?' Of course this bothered me".[3] Harriet Zuckerman (1996) argues that the "question in the minds of leading candidates is not whether they will get the prize but when. In many cases, the signs of a coming prize are unmistakable" (p. 208).[4] She also cites Derek Barton's observation in a New York Times article that scientists have a good idea of where they stand in the international pecking order. But, still, only a few are, in the end, chosen. Samuelson (2002), reflecting on that

[1] https://nationalpost.com/news/canada/life-after-winning-a-nobel-prize-parties-brief-celebrity-and-almost-complete-freedom.

[2] For a discussion, see also Chan and Torgler (2015).

[3] "My wife, who had been up grading papers, answered the phone when it rang that morning, worried that it might interfere with my sleep. She was a bit nasty, she said to me later, but the caller said this was an important phone call for Professor Becker. My wife did not think it was the Nobel Prize, at least not for me. She went and woke me up and I kept saying, 'I want to sleep, I haven't slept so well for a long time'. 'No, it's a call from Sweden', she said, and that was the magic word. A call from Sweden! I did not know that the Prize was announced. But when I heard 'a call from Sweden', I figured, 'well, maybe' and picked up the phone. My wife subsequently said that she was sitting there as I was saying, 'yes, yes' with no expression on my face, and she figured that they had called for my input on somebody else who was being considered. Finally, she hears me say 'Thank you very much; tell the committee what a great honour it is that you have conferred on me'. This of course was the call telling me I had been awarded the Prize. The first thing Guity did was to let out a yell and the first thing I said was 'I'm glad that monkey is off my back' " (Becker, 2004, pp. 269–270).

[4] Frank Wilczek: "Since the early 1980s, I had thought there was a realistic possibility that I'd get the Nobel Prize. Our work was clearly very important for physics, and by then accurate experiments had confirmed it. So each October, around the announcement time, I had a very difficult time sleeping. 2004 was

and the value of a Nobel Prize (or scientific prizes in general) argues[5]: "Yes, there does seem to be life after Stockholm. But this doesn't give a definitive answer to the question: 'Net, are prizes and gold medals good things?' The answer must be Gödel-esque: A Scotch verdict of 'Unprovable'. Is the joy of the universe outweighed by the Weltschmerz of those who do not win? October can be a sombre month in the Senior Common Room: many are called, few are chosen. On the other hand, science, scholarship, and human welfare are bigger than the passing mob of researchers who struggle with them. A more egalitarian society, with no differential payoff to effort and ability, however acquired, might well be a more serene society. One must weigh against this how actual humans have evolved under the realistic Darwinian and cultural conditions of the past: perhaps cumulative progress might then result to be the less? Is there not some realistic trade-off between more equality and more cumulative progress?".

Awards such as the Nobel Prize hold great significance for their recipients beyond their monetary value. The primary motivation for pursuing an award is the social status and recognition it confers, both within the recipient's reference group and beyond (Frey & Gallus, 2017). The limited number of Nobel Prizes awarded relative to the potential pool enforces prestige and status for its recipients. As Merton (1973, p. 442) states, "[o]nce a Nobel laureate, always a Nobel laureate".

In addition, studies have shown that receiving awards can enhance workers' performance, even in the absence of material benefits (Kosfeld & Neckermann, 2011). Within the scientific community, the receipt of prestigious awards such as the John Bates Clark Medal has been found to increase motivation, as measured by post-award productivity, and to increase social status, as measured by pre-publication post-award citation counts, compared to a synthetic control group of scientists with a similar previous research trajectory (Chan et al., 2014a).

While the benefits of receiving awards, such as the Nobel Prize, have been extensively studied, less attention has been given to the effects on those who do not receive

Footnote 4 (continued)

no exception, and I really didn't sleep at all on the night of October 4. At 5:12 a.m. I was in the middle of my intended shower, when my wife came in with our telephone in hand. I hadn't heard any ringing, because of [the] noise of the water. She said, 'There's a woman with a beautiful voice calling from Sweden for you.' I got out of the stall, naked and dripping wet, to take the call. It was the Nobel Prize. Another thing I hadn't anticipated is that the phone call was not just a simple, 'You've won, congratulations, goodbye'. Far from it. I didn't count, and it's somewhat of a blur to me now, but I think that about a dozen officials of the Nobel Foundation, the Swedish Academy of Sciences, and physics friends took up the conversation, one after another. It was wonderful, I had never enjoyed being dazed, naked, and wet all at the same time quite so much, and I don't suppose that I will again" (cited by Johnson, 2013). Kary Mullis (2000, pp. 18–19), in his humorous autobiography, recalls his own mixed experiences with the award: "I was confident I was going to receive the Nobel Prize in 1992. The host of a German TV show had called and explained that each year he did a documentary about the winner of the Nobel Prize in chemistry, and he was preparing the 1992 show. In the past, he had successfully picked every winner of the Prize for chemistry. He claimed he was a very good guesser, but I figured this bastard must get inside information; he must be getting the word from somebody on the committee. That means I'm going to win it this year. His TV crew spent a week filming me in La Jolla and Mendocino. I was very excited. And I was actively humble. As it turned out, I had good reason to be humble. I didn't win. I stopped speculating about when I might get it and I tried not to pay attention. About six months before the 1993 awards were to be announced, my mentor from Berkeley, Joe Neilands, from whom I had learned a little bit about chemistry and a whole lot about life, told me, 'I wouldn't be surprised if you got the Nobel Prize this year. But you'd make it easier for the committee to give it to you if you didn't talk to the press so much. They don't have to give it to you till you're dying'".

[5] https://www.nobelprize.org/prizes/economic-sciences/1970/samuelson/article/.

an award or face delayed recognition. However, recent research suggests that the psychological costs of not receiving an award can be significant, particularly for those who believe they have a good chance of winning. A study by Shi et al. (2017) found that CEOs who were highly likely to win an award but ultimately did not receive it were more likely to engage in risky acquisitions afterwards as a means of enhancing their social status, even if it came at the cost of shareholder returns. Furthermore, the uncertainty associated with delayed recognition can have negative impacts on both psychological and physiological health, as waiting for an uncertain outcome can be challenging (Howell & Sweeny, 2016). Therefore, it is essential to consider the effects of both receiving and not receiving awards in order to fully understand the impact of these accolades on individuals and their behavior.

The psychological and physiological impacts of delayed recognition on individuals who anticipate receiving an award have been relatively underexplored in the literature. Waiting for an uncertain outcome, especially if it might not happen during one's lifetime, can be distressing and can negatively affect both physical and mental health. Howell and Sweeny (2016) note that waiting for delayed recognition can cause psychological distress, and as a result, individuals may experience anxiety, depression, and reduced well-being. Therefore, while the benefits of receiving awards have been extensively studied, the challenges and potential negative effects of delayed recognition on individuals require further attention in the literature.

The Nobel Prize is known for its particularly long waiting time, with laureates waiting an average of over 16 years from the time of their award-winning discovery to receiving the highest recognition in their scientific field, and waiting times of over 30 years not being uncommon. This waiting period can be emotionally draining for scientists who have formed the expectation of having their work recognized. With each passing year, the scientist expecting the Nobel recognition risk being bypassed altogether. In a study where 60 physicists were interviewed, Hermanowicz (2005) showed that scientists often have self-doubts about their own work, even when they are well-established in their careers. Obtaining recognition from their peers through the highest acknowledgement in their profession can help scientists dispel their self-doubts and relieve them from their negative self-perception (Merton, 1973). Therefore, we hypothesize that scientists who had to wait longer to receive the Nobel Prize will experience a greater sense of relief when they are finally recognized.

In general, this paper applies a new way of exploring emotions in science. Previous literature on the relevance of emotions has mainly focused conceptually on the role of emotions in scientists' work. Practical activities involved in 'doing science'—investigating, inquiring, framing, testing, and considering alternatives—require scientists to make choices, use imagination, and engage in commentary; all activities in which emotions are highly likely to play a role (Stocker, 1980). Emotions can thus be seen as a distinct way of thinking, a cognitive mode in which individuals suppress resources or information they otherwise use to think (Minsky, 2006). Indeed, Maslow (1966, p. 109) is convinced that some scientists "secretly relate to their 'problems' in ways analogous to those of lovers to their loved ones", while Polanyi (1958) demonstrates that scientific passions have a logical function, offering indispensable contributions to science. Passion, for instance, helps humans form conceptions of themselves and society and guides assessments of which interests are more important and which are less. Feinstein (2006), in his framework of creative development, describes how important it is for individuals engaged in creative endeavors to manage both positive and negative emotions that arise along the long, winding path of creative development. By exploring how emotions relate to the feedback that scientists receive from their

peers, specifically in the form of delayed recognition for their work, this paper contributes to our understanding of the multifaceted role of emotions in science.

In addition, we aim to explore the role that individual personality traits have on the appraisal of delayed recognition of the Nobel award, specifically focusing on the well-established Big Five personality dimensions, including openness, conscientiousness, extraversion, agreeableness, and neuroticism, and their impact on positive emotions, as well as their interaction with varying time lapses in receiving the award. The role of personality characteristics in science has gained increasing interest in recent years. For example, openness is found to be positively correlated with creative achievement in science (Kaufman et al., 2016; Grosul and Feist 2014; Feist, 1998). Djupe et al. (2020) showed that research productivity (measured by the number of publications) and attention received (measured by citations and h-index) are positively correlated with conscientiousness, but high levels of openness can compensate for lower levels of the former. More recently, the personality of Nobel laureates has been a subject of study. Lebuda and Karowski (2021) conducted a linguistic content analysis to infer the personalities of Nobel laureates and found that extraversion is negatively correlated with Wikipedia presence, while conscientiousness has a positive effect on fame for those in the fields of physics and chemistry. While the Big Five personality dimensions have been studied in relation to scientific output and attention, it is not clear how they affect emotionality related to delayed recognition. Thus, this section of the paper is more exploratory in nature. Nevertheless, we expect that highly extraverted individuals will experience more positive emotions in response to delayed recognition, as they tend to experience more positive emotions in their daily lives (Chen et al., 2020; Gomez et al., 2002; Watson & Clark, 1997). Conscientiousness is another interesting dimension to consider, particularly in the context of delayed recognition. In stressful circumstances, conscientious individuals are shown to rely on goal-oriented behaviors and less on emotional coping mechanisms such as humor (Kaiseler et al., 2012). In the realm of awards, Frey and Gallus (2017) differentiate between two types: confirmatory and discretionary awards. Confirmatory awards are given when predetermined criteria are met or exceeded, while discretionary awards provide the awarding body with the freedom to select the recipient. The Nobel Prize is an example of the latter, as the Nobel committee has complete discretion in choosing who will receive the award. While the Nobel committee takes care to select deserving laureates to maintain the award's prestige, the discretionary nature of the award means that additional efforts from potential Nobelists, such as publishing more papers, do not guarantee receipt of the award. Consequently, conscientious individuals may derive less benefit from goal-oriented coping mechanisms in this context.

Researchers have shown interest in investigating the factors influencing the delay between scientific work that leads to the Nobel Prize and the Prize itself. Polemis and Stengos (2022) find that physicists and chemists who make contributions early in their careers receive the award more quickly, but no difference has been identified for scholars in physiology or medicine. The authors also note that recognition of theoretical contributions is further delayed by three years. Additionally, the number of citations of the laureates' most notable work is linked to a shorter time delay, as is having previously received an award in their career, though the effect varies by discipline (Mitsis, 2022). However, studies suggest that the delay between discovery and award has increased over time (Fortunato et al., 2014; Mitsis, 2022; Polemis & Stengos, 2022). This trend is concerning, as it is possible that the average age of prize reception will exceed life expectancy, meaning that many noteworthy scientific achievements will not receive proper recognition as the Prize cannot be awarded posthumously (Fortunato et al., 2014). The increase in time delay has not been consistent across disciplines, with

physics experiencing a greater increase compared to physiology or medicine, which has experienced a lower increase in time delay compared to chemistry (Becattini et al., 2014). However, this can be explained by the fact that laureates in medicine have had to wait longer than physicists in the past (Chan & Torgler, 2013). Scholars suggest that the reason for the increasing delay in prize recognition is twofold: either the frontiers of science are becoming more difficult to push, making it easier to recognize earlier works, or there is a growing backlog of worthy scientists awaiting recognition (Becattini et al., 2014). Thus, while many studies have examined which factors influence the time delay between scientific discovery and the Prize, few have systematically analyzed the effect that delayed recognition has on Nobel laureates. An exception is Chan et al.'s (2022) study, which examines the effect of award timing on laureates' lifespan.

In general, a growing number of empirical studies have focused on Nobel laureates. For instance, their career patterns or life cycles have been investigated in studies by Stephan and Levin (1993), Jones and Weinberg (2011), Bjørk (2019), Weinberg and Galenson (2019), and Li et al. (2019). Other studies have explored their collaboration patterns before and after receiving the Prize (Chan et al., 2015), their general collaboration patterns (Kademani et al., 2005), the intensity and success of their collaborations (Chan et al., 2016), and their proximity to co-authors (Fields, 2015). Furthermore, their success in receiving awards based on their educational background and specialization has been explored (Chan & Torgler, 2015), as well as their standing based on bibliometric data (Kosmulski, 2020), their mentoring relationships and networks (Chariker et al., 2017), and the institutions where they conducted their prize-winning work (Schlagberger et al., 2016). Additionally, there has been an interest in the distribution of Nobel laureates across countries and research organizations (Heinze & Fuchs, 2022), and in the evolution of their award success patterns before and after receiving the Nobel Prize (Chan et al., 2014b).

There has also been substantial interest in understanding the correlation between receiving specific awards and being awarded the Nobel Prize (Chan & Torgler, 2012; Chan et al., 2018; Chong et al., 2012; Ye et al., 2013), as well as identifying factors, such as bibliometric data, that can help predict Nobel Prize winners (Gingras & Wallace, 2010).

A limited number of studies have examined Nobel laureates' speeches directly. Condit (2018) analyzed how Nobel speeches portray science and scientists to a broader audience, revealing varying degrees of success in achieving a positive influence beyond the scientific community, with laureates often failing to convey their goodwill toward humanity. Bucchi et al. (2019) further demonstrated that in the first half of the twentieth century, there was greater emphasis on highlighting the beneficial impact of science on humanity, compared to subsequent periods. In this study, we aim to explore the emotional discourse of Nobel banquet speeches in relation to the delay in receiving the award.

Emotions are difficult to consistently explore in academia due to the influence of contextual factors, such as scholars' experiences at a particular moment in time and their relationship to a specific outcome. Nobel laureate banquet speeches offer an opportunity to investigate emotions in a consistent and controlled manner as they are comparable among scientists and, over time, measure the same individual responses to the same recognition (i.e., the Nobel Prize) under the same circumstances. Nobel laureates also share similar ambitions, hopes, and motivations in terms of success, recognition, and acknowledgment. In addition to the Nobel banquet speeches, laureates typically give a Nobel lecture, but this can be presented up to six months after receiving the award, must focus on the work that led to the prize, and is directed towards a more technical audience (Condit, 2018). By contrast, the banquet speech is thematically unconstrained and less academic, providing a better setting to measure the importance of emotions.

To explore the level of emotionality, we will rely on linguistic content analysis. The banquet is interesting to explore as emotionality in society often plays an important role in our ritual lives (Whitehouse, 2021). The banquet, which is a key social event in Sweden, is a highly ritualized event, as are other activities during the Nobel Week, which takes place directly after the Nobel Prize ceremony at the City Hall in which 1300 people are invited, and Swedish families can watch on TV (Frantz, 2011).[6] George Stigler (1985, p. 89), another Nobelist points out: "The main effect of the Prize is to endow the recipients with a large measure of prestige among non-scientists. In this respect, the award has been a phenomenal success. The annual ceremonies give the Swedish community a publicity that must be the envy of every advertising executive. For the average educated citizen, there is no possibility of understanding the work that won the Prize, or of tracing any connection between that work and contemporary wellbeing. Even the uneducated citizen knows that the laureate is a Life Baron in science… The public has good reasons for what it does, and it is the task of the social scientist to discover them, even though many find it irresistibly attractive to instead ridicule the public's behaviour. My conjecture is that the public wishes to admire superior performance in every legitimate calling, athletic and military (for example) as well as scientific".

Data and methods

We obtained the Nobel Prize banquet speeches laureates in the fields of physics, chemistry, and physiology or medicine between the years 1901 and 2008 from the official website for the Nobel Prize (https://www.nobelprize.org/). We excluded speeches after 2008 because we relied on the year of work of the Nobel laureates as reported by Jones and Weinberg (2011). In total, we collected 301 speeches, but we excluded speeches given in languages other than English, leaving us with a final sample of 223 speeches (chemistry, $n=62$; physics, $n=76$; physiology or medicine, $n=85$).[7] The speeches vary in length as there are no specific guidelines on their content or duration. On average, the banquet speeches consist of 408 words (SD = 175.47). The shortest speech is 56 words long, while the longest speech has 1082 words.

We collected additional bibliographical information from the official website of Nobelists, including gender, date of birth, nationality, and country of doctoral studies (if available). To determine the year of work for which Nobel laureates were awarded, we referred to Jones and Weinberg's (2011) work, which also provided information on whether the work was primarily theoretical or both theoretical and empirical. Li et al. (2019) provided further details on the number and years of publication of Nobel laureates. We used this information to calculate the total number of publications up to the reception of the Nobel Prize and the number of publications between the year of work and the Prize reception. The authors also identified the publication(s) that contained the work for which the Nobel Prize is awarded (i.e. winning papers) by examining, among other sources, the biographies of laureates on the official Nobel website, Wikipedia entries, and the number of citations. To ensure accuracy, we calculated the time lapse between the work and prize reception as the time between the publication of the scholar's winning paper and the Nobel reception. As some laureates have multiple papers published in different years listed as

[6] See https://www.theguardian.com/science/blog/2011/dec/08/survive-nobel-prize-festivities.

[7] We excluded one speech from the analysis, which did not have information on the year of the work.

Table 1 Differences between nobelist who delivered the banquet speech and other nobelists

	Nobelist who delivered the speech	Other nobelists	Diff	*p*-value
Time lapse	17.6	16.5	1.1	0.209
Age at Nobel Prize	55.5	54.3	1.2	0.240
Proportion female	0.022	0.023	−0.001	0.963
#Publications up to Nobel Prize	101.8	79.5	22.3	0.055
#Publications between discovery and Nobel Prize	74.5	57.3	17.2	0.085
#Major awards before Nobel Prize	4.5	2.9	1.6	< 0.001

their winning papers, we calculated the time lapse for the first winning paper, the last winning paper, and the rounded average of winning papers' year of publication. The values did not differ significantly among the three alternative measurements of time-lapse data.

We also examine the number of major awards that each laureate had received prior to the Nobel Prize, based on data collected by Chan et al. (2014b), covering all laureates between 1901 and 2000. The data were derived from Kurian's (2002) *Nobel Scientists: A Biographical Encyclopedia*. These awards include major field recognitions such as the Copley Medal, the Max Planck Medal, or the Franklin Medal, while more specific recognitions, such as honorary doctorates, are not included.

Differences between the sample of nobelists who held a nobel banquet speech and other nobelists

It should be noted that not all Nobelists give a banquet speech at their prize reception. Some Nobelists make the decision not to give a speech. In years when multiple awards are given to the same discipline, typically, only one of the winners of each discipline gives a speech. In addition, we excluded speeches that were not availab1le in English. Thus, we checked for potential selection effects by exploring the potential differences among our sample and the other Nobelists not included in our analysis (see Table), looking at core factors. First, we examined whether there are major differences in the time-lapse of prize reception, our main variable of interest in our analysis. The laureates in our sample had to wait, on average, 17.61 years to receive the Nobel award after the discovery, while the Nobelists outside our sample had to wait 16.47 years, but the difference is not statistically significant at any conventional level. When looking at demographic factors such as age and gender, we also find no major differences, and while the Nobelists who gave the speech tend to be older on average, the difference is not statistically significant. It has been said that usually the eldest from each prize area does the speech (Frantz, 2011). However, when checking variables related to their work and career, we found some differences between our sample and other Nobelists. Those who gave the banquet speech have published more papers in their career up to the year of prize reception ($p < 0.10$), and are also more likely to have published more papers between the year of their award-winning discovery and the Prize ($p < 0.10$). They have also received more other major awards before the Nobel Prize ($p < 0.001$).

Linguistic text content analysis to measure emotions and personality characteristics

Measuring emotions

As a dependent variable, we focused on positive emotions in the Nobel Prize banquet speech. To analyze the text, we use the Linguistic and Word Count Analysis (LIWC) developed by Pennebaker et al. (2007), which categorizes texts based on a series of predefined categories (Boyd et al., 2022). We did not perform any text pre-processing, but the 2022 LIWC dictionaries include word stems, which can detect derivatives of a word with a similar meaning in the analyzed texts. Some studies have looked at the accuracy of LIWC by categories in reliably detecting emotional states. For example, Bantum and Owen (2009) looked at the detection of the emotion of cancer patients' narratives with the use of LIWC. They found a high accuracy in detecting positive and negative emotions better than similar computerized alternatives such as PCAD. Other researchers have shown a positive correlation between the use of words labelled as negative emotions in LIWC and depression among individuals (Morales & Levitan, 2016). LIWC has also been applied to study emotions in the scientific domain. Jiang (2021) studies the emotions scientists experience during the peer review process by looking at a website where researchers can post their experiences with reviewers and rate them. The author finds that certain characteristics of the peer-review process, such as a high turnaround, increased words associated with positive emotions but a slower process, does not increase negative emotions. The role of emotions has also been used as a proxy for the grant-decision-making process to determine the role emotions play in the evaluation by doing a linguistic analysis of review reports (Van den Besselaar et al., 2018). Research in this domain has also looked at how emotions affect the life of academics as well. A study has found that the use of positive emotions in the autobiographies of famous psychologists is correlated with longevity, while negative emotions do not have a significant effect (Pressman & Cohen, 2012). For our analysis, we were interested in looking at positive emotional states of scientists as the Nobel Prize reception is a positive event. LIWC includes in total 406 positive emotional words, including words such as good, love, happy and hope and provides the percentage of words that fall under this category. The process of collecting the broad set of words in each is based on previous literature regarding emotion scales, thesauri, and standard English dictionaries. Several independent judges are then instructed to review these sets of words over several years and decide whether each word should be included or excluded from the dictionary. Detailed descriptions of the word collection process and testing of internal reliability and external validity are discussed in Pennebaker et al. (2007) and Tausczik and Pennebaker (2010).

Figure 1 shows the distribution of the percentage of positive emotions in text by scientific field and for the overall sample. The 222 banquet speeches analysed in this study have an average of 1.4% ($SD = 0.84\%$) positive emotion words in the text, and the distributions for all three fields and in total are rightly skewed. A few speeches ($n = 7$) do not show any positive emotions, while the maximum value within our sample is 5.08%. Nobel laureates in physics show, on average, fewer positive emotions $M = 1.26\%$ ($SD = 0.69\%$) than laureates in medicine $M = 1.42\%$ ($SD = 0.85\%$) and chemistry $M = 1.53\%$ ($SD = 0.97\%$).

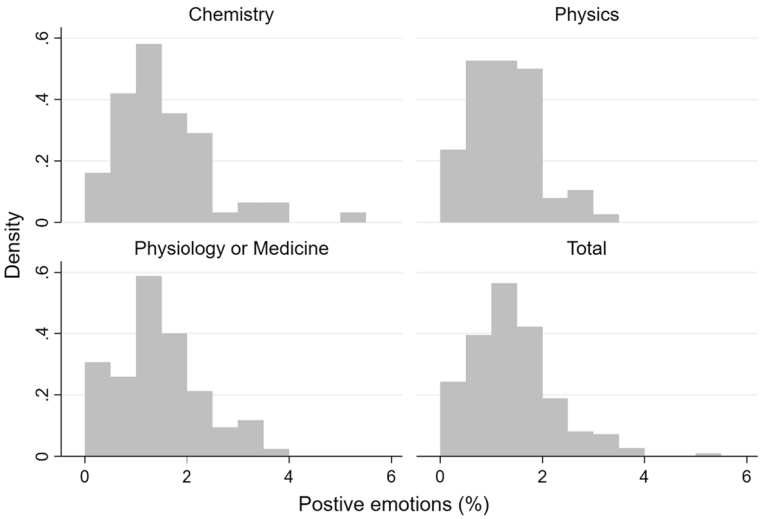

Fig. 1 Distribution of positive emotions in the text by field. Bin width = 0.5

Measuring personality characteristics

In addition to looking at emotions in text, we also look at personality characteristics prediction based on text analysis. There is a growing interest in predicting personality based on Natural Language Processing (NLP). One of the tools used for personality prediction is Apply Magic Sauce (AMS) provided by The Psychometrics Centre at the University of Cambridge (https://applymagicsauce.com) (Kosinski et al., 2013). AMS gives a prediction for each category of the Big 5 personality traits (i.e., openness, conscientiousness, extraversion, agreeableness and neuroticism). A score between 0 and 1 is provided, which can be interpreted as a percentile of the personality trait compared to the general population. One major limitation of the personality detection algorithms currently available is that it is not clear which parameters are being used to calculate the scores as it is not fully disclosed to the researcher which training model as well as which training data are used. Nonetheless, personality detection through speech has previously been used in the literature to infer Nobelists' personalities and how this affects their popularity levels as well as differences in personality among more artistic vs more scientific inclined laureates (Lebuda & Karwowski, 2021). Despite this, most of the research on personality detection on the text has been applied in the context of social media (Kosinski et al., 2015; Youyou et al., 2015). As the application of personality detection methods on large texts is limited, we calculated the personality scores for each sentence within the speech. We then calculated the personality of each laureate as the average score of the sentences within each speech. For robustness, we also calculated the personality scores of each laureate as the weighted average (by the number of words). The correlation between both methods is very high: 93.08% for openness, 91.36% for conscientiousness, 88.81% for extraversion, 89.51% for agreeableness, and 92.13% for neuroticism. For the summary statistics of all independent variables utilized in the empirical analysis, see Table 7 in the Appendix.

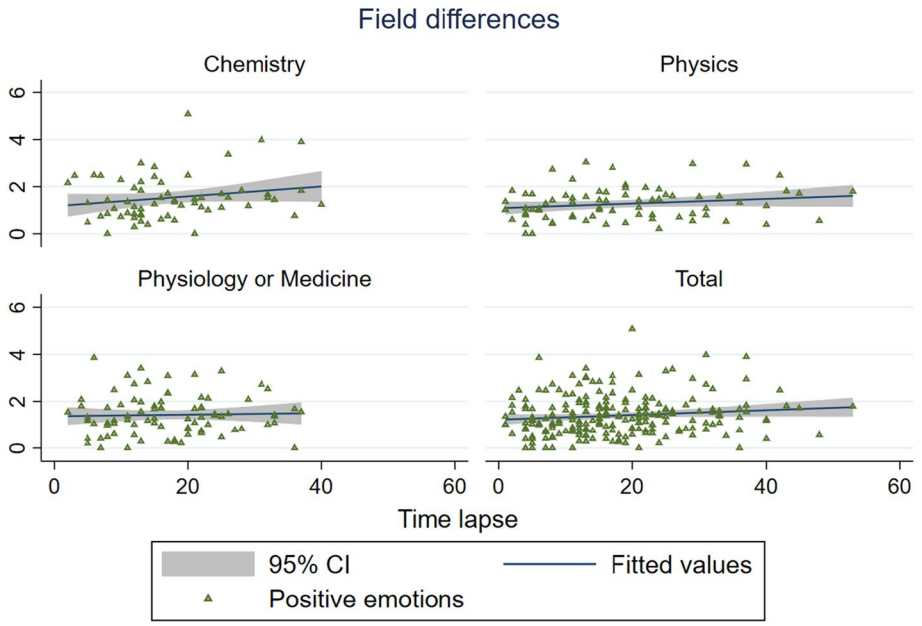

Fig. 2 Correlation between time lapse and positive emotions in banquet speech by field and in total

Empirical results

Figure 2 presents the correlation between time lapse and positive emotions in the banquet speeches by field. While the correlation between time lapse and positive emotions is higher in chemistry ($\rho = 0.197$; $p = 0.1243$; $n = 62$) and physics ($\rho = 0.180$; $p = 0.1207$; $n = 76$) compared to medicine ($\rho = 0.034$; $p = 0.7589$; $n = 84$), these values are not statistically significant due to the low number of observations by field. However, the overall sample, which has a larger number of observations, shows a statistically significant Pearson's correlation of $\rho = 0.123$ at the 10% significance level ($p = 0.0674$; $n = 222$). In the empirical analysis, controlling for fields accounts for differences in the waiting time across fields (Chan & Torgler, 2013). Additionally, it is worth noting that theorists generally wait longer for the Nobel Prize than empirically oriented scholars (almost 1.5 years longer), although this difference is not statistically significant.

Figure 3 displays the relationship between time lapse and positive emotions in the banquet speeches, categorized into four distinct periods corresponding to the years when the Nobel Prize was awarded. This approach allows us to account for the historical and contextual factors surrounding the Nobel Prize ceremony, which may influence the display of emotions in speeches. We also consider the findings of Bucchi et al. (2019), who show that over time Nobel banquet speeches become more technical, which could lead to a lower display of emotionality overall. To ensure an equitable distribution of observations, we divide the speeches into four quartiles, each with an equal number of observations. The first quartile encompasses 56 speeches delivered between 1902 and 1955, the second quartile comprises 56 speeches delivered between 1956 and 1973, the third quartile includes 55 speeches delivered between 1974 and 1989, and the fourth

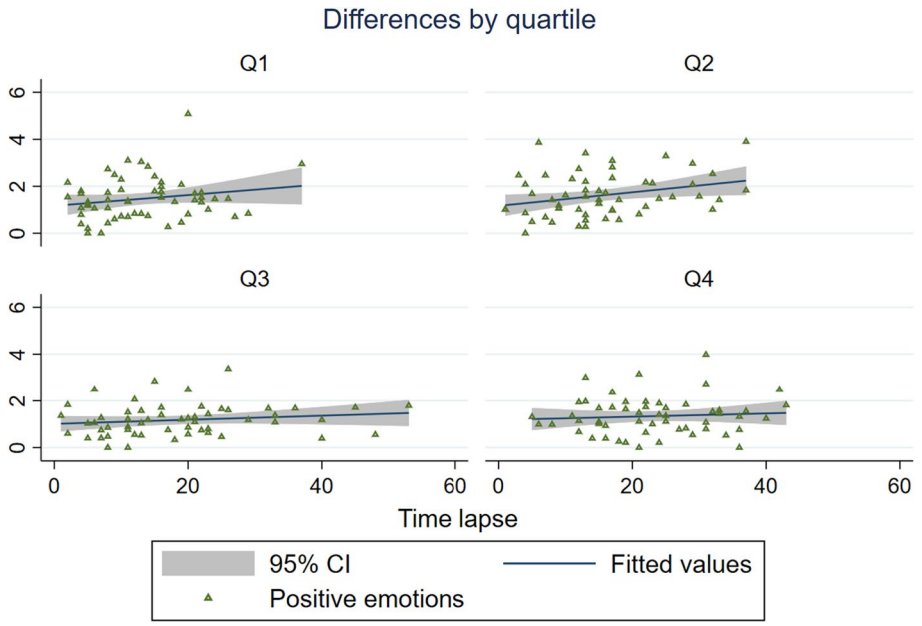

Fig. 3 Correlation between time lapse and positive emotions in the banquet speech by quartiles

quartile contains 55 speeches delivered between 1990 and 2008. Differences in the length of the time periods are a consequence of variations in the number of speeches delivered each year and a higher proportion of speeches given in languages other than English during the first period.

The Pearson's correlation scores for each time period are $\rho = 0.195$ ($p = 0.1494$; $n = 56$) for the first quartile, $\rho = 0.289$ ($p = 0.0305$; $n = 56$) for the second quartile, $\rho = 0.155$ ($p = 0.2589$; $n = 55$) for the third quartile, and $\rho = 0.081$ ($p = 0.5567$; $n = 55$) for the fourth quartile. This indicates that the effect of time lapse on positive emotions varies over time, with the first two quartiles showing a steeper slope compared to the last two quartiles.

To examine the robustness of the descriptive analysis, we explored the relationship between *time lapse* and *positive emotions* using ordinary least squares (OLS) regressions and controlling for a set of Nobel laureate characteristics such as time dummies to control for unobserved time contextual factors, fields of the Nobel Prize, whether their work was theoretical or empirical, and the gender of the Nobelists. We also reported standardized coefficients to identify the relative strength or importance of our core independent variable relative to the other factors we controlled for. Across all three specifications in Table 2, the coefficient for time lapse is statistically significant at the 1% level, with a positive sign indicating that waiting longer for the Nobel Prize is positively correlated with expressing more positive emotions in the Nobel banquet speech. The effect size increases as we control for further factors. For example, specification (3) indicates that an increase of one standard deviation in time lapse produces an increase in positive emotions of 0.202 standard deviations.

Regarding the other factors, most do not seem to affect the emotional positivity of the speech, although there is some heterogeneity in terms of the time periods (relative to the reference group of the fourth quartile). The second quartile, for instance, elicits

Table 2 Time lapse and positive emotions

	(1) Positive emotions	(2) Positive emotions	(3) Positive emotions
Time lapse	0.0152**	0.0160**	0.0165**
	(0.00548)	(0.00543)	(0.00542)
	0.186	*0.196*	*0.202*
1st quartile	0.282†	0.317†	0.333†
	(0.170)	(0.173)	(0.176)
	0.146	*0.164*	*0.173*
2nd quartile	0.392*	0.402*	0.423*
	(0.163)	(0.162)	(0.168)
	0.203	*0.208*	*0.219*
3rd quartile	−0.0982	−0.0825	−0.0559
	(0.141)	(0.141)	(0.150)
	−0.0506	*−0.0425*	*−0.0288*
Nobel in chemistry		0.124	0.154
		(0.154)	(0.158)
		0.0663	*0.0826*
Nobel in physics		−0.175	−0.137
		(0.118)	(0.122)
		−0.0991	*−0.0775*
Theoretical work			−0.149
			(0.129)
			−0.0721
Female			0.0427
			(0.328)
			0.00756
N	222	222	222
R^2	0.068	0.088	0.093
Adj. R^2	0.051	0.062	0.059

Ordinary least squares (OLS) regressions. Standard errors (robust) in parentheses. Standardized beta coefficients in italics. Reference categories: 4th quartile (time period between 1990 and 2008) and Nobel Prize in Physiology/Medicine

Numbers in italics refer to Standardized beta coefficients, which is stated in the corresponding table notes

†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$

the strongest positive emotional response (statistically significant at the 5% level in the OLS setting). The first quartile is also positive and significant at the 10% level. The first two quartiles may show a higher emotional response due to covering a turbulent historical period (WWII) and a period of post-war hope and rebuilding. This coincides with the observation of Bucchi et al. (2019) that speeches become more technical towards the 1970s decade. In the Appendix, 8 reports specifications adjusting for time periods using dummies for the periods 1901–1927 ($n = 8$), 1928–1954 ($n = 45$), and 1955–1981 ($n = 87$), with 1982–2009 as the reference group ($n = 82$). The results of these specifications are comparable to those of the main analysis, with the coefficient for time lapse

remaining statistically significant across all specifications. This indicates that the relationship between time lapse and positive emotions in the Nobel banquet speeches holds even when accounting for differences across time periods.

Next, we control for Nobelists' publication performance success or award recognition (see Table 3). In specification (1), we add as a variable the number of publications up to the Nobel Prize, in specification (2) the number of publications between the Nobelists' year of work and prize reception, and in specification (3) the number of major awards obtained before the Nobel Prize. In specification (3), the number of observations decreases due to the major awards variable being recorded only for Nobel Prize winners before 2000 ($n = 24$). We find that publication success tends to have a negative effect on emotional positivity, ceteris paribus, although the effect is not statistically significant. Notably, the quantitative effects and statistical significance of time lapse tend to increase after controlling for publications and recognitions, especially in specifications (1) and (2).

As additional robustness tests, we account for Nobelists' heterogeneity by reporting specifications with standard error adjustments clustering over different factors (see Table 4). Specification (1) reports results with standard error adjustments clustering at the country of the Nobelists' educational background (PhD), specification (2) at the Nobelists' age at the time of the Nobel award reception, and specification (3) at their nationality level. As shown, the effect of the variable time lapse remains statistically significant in all specifications.

As discussed previously, we also explore personality characteristics through the Nobel Prize banquet speech (see Table 5). The relationship between time lapse and positive emotions remains robust (as shown in specification (1)), with effects that are comparable to those found beforehand. Specifically, a one standard deviation increase in time lapse increases positive emotionality by 0.186 standard deviations. Interestingly, Nobelists who show a higher level of extraversion exhibit more positive emotionality, with a relative effect size that is slightly smaller than that of time lapse (beta coefficient of 0.158). This result is consistent with previous empirical evidence showing that positive emotions are correlated with extraversion (for an overview of studies, see Chen et al., 2020), as well as studies that have used the LIWC dictionary specifically (Mehl et al., 2006; Pennebaker & King, 1999).

When examining the interaction between personality characteristics and time lapse, we find that conscientiousness is the only trait that has a significant impact. Conscientiousness is a personality trait that is related to an individual's ability to plan, set goals, achieve tasks, and manage them carefully (Boyce et al., 2010; Murphy et al., 2013; Watson & Clark, 1992). Previous studies have shown that conscientiousness has positive effects on life outcomes such as health, wellbeing, and longevity, attributed to greater concern for protective factors (Chapman et al., 2007; Dahm et al., 2017; DeNeve & Cooper, 1998; Kern & Friedman, 2008; Murphy et al., 2013; Steel et al., 2008). Therefore, conscientious individuals are more likely to maintain a lifestyle that promotes good health and minimizes health risks (Bogg & Roberts, 2004), and exhibit a problem-solving approach to stress (Connor-Smith & Flachsbart, 2007). However, evidence suggests that conscientiousness might be less beneficial during uncontrollable stress (Boyce et al., 2010; Dahm et al., 2017). Conscientious individuals may not cope well with stress compared to less conscientious individuals, as indicated by physiological markers (Murphy et al., 2013). Additionally, research suggests that highly conscientious individuals experience more stress in response to chronic stress, failure, and perceived negative social evaluation (Dahm et al., 2017). The Nobel Prize waiting period is uncontrollable, which may take a toll on the emotional states of Nobel laureates, potentially explaining the negative correlation of the interaction effect. As the waiting time for the Nobel Prize

Table 3 Controlling for publication performance and recognition factors

	(1) Positive emotions	(2) Positive emotions	(3) Positive emotions
Time lapse	0.0174**	0.0177**	0.0161**
	(0.00556)	(0.00565)	(0.00608)
	0.214	*0.218*	*0.197*
Nobel in chemistry	0.174	0.163	0.239
	(0.164)	(0.163)	(0.173)
	0.0941	*0.0880*	*0.128*
Nobel in physics	−0.195	−0.190	−0.172
	(0.120)	(0.120)	(0.125)
	−0.111	*−0.108*	*−0.0979*
1st quartile	0.246	0.269	0.254
	(0.175)	(0.175)	(0.195)
	0.127	*0.138*	*0.135*
2nd quartile	0.345*	0.365*	0.344†
	(0.168)	(0.168)	(0.188)
	0.180	*0.191*	*0.186*
3rd quartile	−0.111	−0.0976	−0.111
	(0.146)	(0.147)	(0.171)
	−0.0576	*−0.0508*	*−0.0598*
Theoretical work	−0.135	−0.136	−0.0974
	(0.131)	(0.131)	(0.133)
	−0.0659	*−0.0666*	*−0.0486*
Female	−0.00952	−0.000227	0.00891
	(0.320)	(0.325)	(0.323)
	−0.00171	*−0.0000408*	*0.00168*
#Publications up to Nobel Prize year	−0.000545		−0.000648
	(0.000420)		(0.000440)
	−0.0926		*−0.108*
#Publications between year of prize − winning work and Nobel Prize		−0.000498	
		(0.000398)	
		−0.0773	
#Awards before the Nobel Prize			0.00499
			(0.0191)
			0.0234
N	219	219	196
R^2	0.102	0.101	0.109
Adj. R^2	0.063	0.062	0.061

Ordinary least squares (OLS) regressions. Standard errors (robust) in parentheses. Standardized beta coefficients in italics. Reference categories: 4th quartile (time period between 1990 and 2008) and Nobel Prize in Physiology/Medicine

Numbers in italics refer to Standardized beta coefficients, which is stated in the corresponding table notes

†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$

Table 4 Clustering over educational background, age, and nationality

	(1) Positive emotions	(2) Positive emotions	(3) Positive emotions
Time lapse	0.0174***	0.0174***	0.0174***
	(0.00401)	(0.00491)	(0.00430)
Nobel in chemistry	0.174†	0.174	0.174
	(0.0838)	(0.150)	(0.103)
Nobel in physics	−0.195**	−0.195	−0.195**
	(0.0617)	(0.118)	(0.0665)
1st quartile	0.246	0.246	0.246
	(0.196)	(0.179)	(0.279)
2nd quartile	0.345	0.345*	0.345†
	(0.210)	(0.170)	(0.195)
3rd quartile	−0.111	−0.111	−0.111
	(0.169)	(0.157)	(0.176)
Theoretical work	−0.135	−0.135	−0.135
	(0.168)	(0.124)	(0.129)
Female	−0.00952	−0.00952	−0.00952
	(0.441)	(0.327)	(0.399)
#Publications up to Nobel Prize year	−0.000545	−0.000545	−0.000545
	(0.000422)	(0.000374)	(0.000433)
N	219	219	219
R^2	0.102	0.102	0.102
Adj. R^2	0.063	0.063	0.063

Ordinary least squares (OLS) regressions. Clustered standard errors in parentheses. Specification (1) provides standard errors clustered at the country of educational background (PhD). Specification (2) provides standard errors clustered at the age of Nobel award reception. Specification (3) provides standard errors clustered at the country of nationality level. Reference categories: 4th quartile (time period between 1990 and 2008) and Nobel Prize in Physiology/Medicine

†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$

increases, it may become more challenging for highly conscientious individuals to cope. Therefore, an additional year of waiting for the Nobel Prize might be more emotionally taxing for highly conscientious scholars, reflected in less positive emotionality in their banquet speeches (meaning that the relief element is less dominant). Figure 4 shows the negative effect by presenting the predicted levels of conscientiousness on positive emotions in the banquet speech at the sample average for time lapse.

Finally, we tested the robustness of our primary independent variable by using an alternative dataset, as explained in the Methods section. Li et al. (2019) linked papers to Nobel Prize success by distinguishing between the first published paper that contributed to the scientists receiving the Nobel Prize and their last published paper (see Table 6). We recalculated the time lapse independently by examining the distance to the Nobel Prize based on the first published paper (specification (1)), the last published paper (specification (2)), and the average year (specification (3)). We adjusted the publication counts to match the revised time lapse variable for all three specifications. All three new

Table 5 Emotions, time lapse, and personality characteristics

	(1) Positive emotions	(2) Positive emotions
Time lapse	0.0151**	0.112
	(0.00539)	(0.113)
	0.186	*1.385*
Nobel in chemistry	0.129	0.196
	(0.161)	(0.168)
	0.0695	*0.106*
Nobel in physics	−0.244*	−0.204
	(0.122)	(0.123)
	−0.139	*−0.116*
1st quartile	0.151	0.0851
	(0.169)	(0.163)
	0.0777	*0.0437*
2nd quartile	0.270	0.279
	(0.165)	(0.170)
	0.141	*0.146*
3rd quartile	−0.133	−0.120
	(0.155)	(0.150)
	−0.0693	*−0.0624*
Theoretical work	−0.0566	−0.0859
	(0.136)	(0.138)
	−0.0277	*−0.0420*
Female	0.00139	−0.0139
	(0.322)	(0.316)
	0.000249	*−0.00250*
Publications up to Nobel Prize year	−0.000331	−0.000399
	(0.000415)	(0.000405)
	−0.0563	−0.0678
Extraversion	2.036*	1.460
	(0.921)	(1.614)
	0.158	*0.113*
Openness	−0.270	0.350
	(0.686)	(1.391)
	−0.0268	*0.0347*
Conscientiousness	1.776	6.792**
	(1.510)	(2.557)
	0.120	*0.459*
Agreeableness	1.169	−0.626
	(1.028)	(2.312)
	0.0900	*−0.0482*
Neuroticism	1.550	1.034
	(0.968)	(1.900)
	0.129	*0.0863*
Time lapse # extraversion		0.0299

Table 5 (continued)

	(1) Positive emotions	(2) Positive emotions
		(0.0734)
Time lapse # openness		−0.0364
		(0.0623)
Time lapse # conscientiousness		−0.233*
		(0.104)
Time lapse # agreeableness		0.0748
		(0.0910)
Time lapse # neuroticism		0.0367
		(0.0878)
N	219	219
R^2	0.151	0.177
Adj. R^2	0.092	0.098

Ordinary least squares (OLS) regressions. Standard errors (robust) in parentheses. Standardized beta coefficients in italics. Reference categories: 4th quartile (time period between 1990 and 2008) and Nobel Prize in Physiology/Medicine

Numbers in italics refer to Standardized beta coefficients, which is stated in the corresponding table notes

$^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

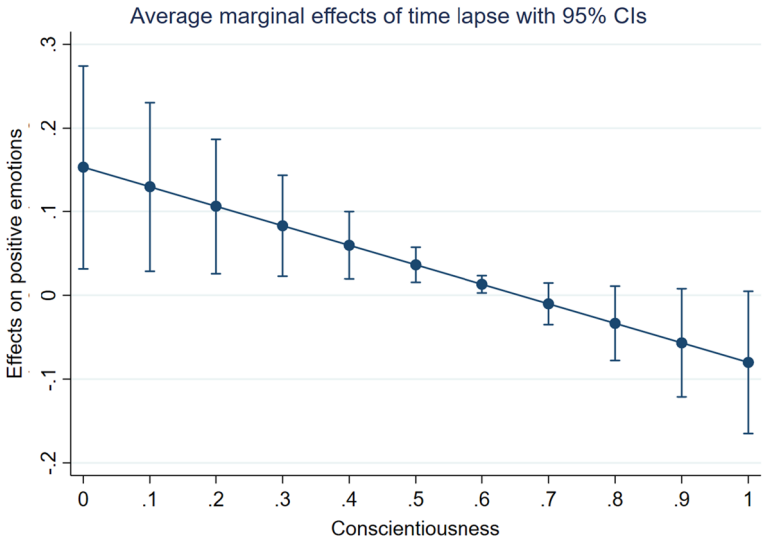

Fig. 4 Predicted levels of conscientiousness on positive emotions in banquet speech

time lapse proxies yielded coefficients that were statistically significant at the 1% level, which supports and strengthens the relationship between time lapse and positive emotional responses.

Table 6 Alternative proxies for time lapse

	(1)	(2)	(3)
	Positive emotions	Positive emotions	Positive emotions
Nobel in chemistry	0.150	0.151	0.152
	(0.0973)	(0.100)	(0.0986)
Nobel in physics	−0.194**	−0.206**	−0.200**
	(0.0660)	(0.0668)	(0.0665)
1st quartile	0.211	0.213	0.213
	(0.289)	(0.294)	(0.291)
2nd quartile	0.326	0.335	0.331
	(0.206)	(0.211)	(0.208)
3rd quartile	−0.133	−0.130	−0.131
	(0.188)	(0.189)	(0.189)
Theoretical work	−0.134	−0.127	−0.132
	(0.130)	(0.138)	(0.133)
Female	−0.00153	0.00958	0.00511
	(0.417)	(0.393)	(0.404)
Time lapse from first winning paper	0.0128**		
	(0.00386)		
#Publications between first winning paper and Nobel	−0.000605		
	(0.000453)		
Time lapse from last winning paper		0.0139**	
		(0.00397)	
#Publications between last winning paper and nobel		−0.000643	
		(0.000462)	
Time lapse from average year of winning papers			0.0135**
			(0.00397)
#Publications between average of winning papers and nobel			−0.000625
			(0.000458)
_cons	1.173***	1.168***	1.166***
	(0.105)	(0.108)	(0.107)
N	219	219	219
R^2	0.086	0.089	0.088
Adj. R^2	0.046	0.050	0.049

Ordinary least squares (OLS) regressions. Robust standard errors in parenthesis clustered at the country of nationality level. Reference categories: 4th quartile (time period between 1990 and 2008) and Nobel Prize in Physiology/Medicine

†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$

Conclusions

In our study, we have discovered a robust association between the length of time that scientists waited to receive the Nobel Prize for their work and the positive emotional response

that they expressed during their Nobel Prize banquet speeches. Our findings may suggest that waiting for the Nobel Prize places significant personal pressure, expectations, and tension on potential Nobel Prize candidates, which are released in a great sense of relief once the Prize is awarded. This relief is manifested in the form of positive emotional responses during the banquet speech, which become more intense as the waiting time increases. Our results are statistically and economically significant, with a relatively large quantitative effect compared to other factors. While we cannot directly measure relief, complementing this analysis with survey and interview data could provide additional insights. However, the anecdotal evidence presented at the beginning of the paper lends support to this interpretation.

Naturally, our empirical analysis has some limitations and opportunities for further research. For instance, future studies could expand our dataset by incorporating additional years into the analysis or by including the Nobel Prize in economics. Furthermore, although we examine emotionality in a highly regulated environment, we cannot account for all potential factors. For example, we cannot exclude the possibility that individual contextual factors, such as Nobel laureates' personal circumstances like health and well-being issues, could affect how they express themselves during the banquet speech, although it is unclear how this would affect the observed relationship between waiting time and emotionality.

While LIWC is a widely-used linguistic dictionary and was well-suited for our analysis, it is possible that our results could be further validated by exploring alternative dictionaries such as Whissell's Dictionary of Affective Language (Whissell, 2009) or the SemEval 2007 test data extracted from the WordNet Affect domain (Strapparava & Mihalcea, 2007). Additionally, future studies could investigate different dimensions of positivity, such as joy or surprise, and examine their relationship with waiting time for the Nobel Prize. However, given the relatively short length of Nobel Prize banquet speeches, analyzing overall positivity using LIWC's five basic emotional dimensions (positive, negative, anxiety, anger, and sadness) was an appropriate starting point for our study. As technology and AI continue to improve, we anticipate that content-analysis methods will become even more refined and accurate in determining the meaning of text. Current challenges include properly identifying figurative language such as irony, sarcasm, and affective metaphors, where secondary meanings are intentionally profiled. Future studies could attempt to identify a Nobelist's potential "baseline" emotionality to see the relative change in their banquet speech. However, identifying such a baseline is challenging, as different documents are subject to individual contextual circumstances. Additionally, this would mean deviating from a more controlled environment, and as such, comparisons between Nobel laureates become more challenging. The beauty of our context is that we are exploring the same condition and situation (banquet speech) across all Nobel laureates and time, providing a relatively homogeneous setting for comparisons. As technological AI advances improve, content-analysis methods will likely become better equipped to accurately determine the true meaning of a statement.

Moreover, measuring emotionality over a long period of time can present additional challenges. As time passes, the customs and expectations around what is considered appropriate to say or not say during a Nobel Prize banquet speech may evolve. Spoken discourse is influenced by the prevailing norms and speech culture, which also evolve over time (Hart, 2023). Additionally, while LIWC is widely recognized as the gold standard for psychometric measurements in text and has been validated, its applicability to historical texts may be less clear (Martins & Baumard, 2022). This is a challenge not only for our study,

but for all research that relies on linguistic dictionaries. However, we attempted to address this issue empirically by controlling for different time periods in our analysis.

Measuring personality characteristics via text poses similar challenges. Most of the training data used to develop algorithms come from more recent years, which makes it difficult to know how adequate the personality traits identified are in less recent speeches. However, our results show a positive correlation between extraversion and positive emotions, which is consistent with the literature (Tausczik and Pennebacker, 2010; Chen et al., 2020). This provides some confidence that potential biases might be less problematic. Nevertheless, caution should be exercised when interpreting personality scores developed with tools that rely on more recent data sources.

Overall, the current study's beauty is identifying an interesting setting to explore consistently whether and how emotions play a role in academia. Our results indicate that emotionality plays a role when focusing on prize reception. Ultimately, our study underscores the importance of emotions in scientific discourse and encourages further research in this area. By better understanding the emotional underpinnings of academic achievement, we may gain insights into the human experience of science and enhance our ability to communicate science to a wider audience.

Appendix

See Tables 7 and 8.

Table 7 Summary statistics control variables

Variables	*N*	Mean	SD	Min	Max
Time lapse	222	17.6	10.3	1	53
Nobel in physics (%)	222	34.2%			
Nobel in chemistry (%)	222	27.9%			
Nobel in physiology or medicine (%)	222	37.8%			
Theoretical work (%)	222	20.7%			
Female (%)	222	2.2%			
#Publications up to Nobel Prize	219	101.8	141.9	1	1303
#Publications between discovery and Nobel Prize	219	74.5	129.6	0	1258
#Major awards before Nobel Prize	199	4.5	3.9	0	22
Openness	222	.631	.083	.373	.846
Conscientiousness	222	.589	.056	.458	.803
Extraversion	222	.387	.065	.235	.578
Agreeableness	222	.476	.064	.300	.690
Neuroticism	222	.438	.070	.292	.627

Table 8 Alternative time period specification

	(1)	(2)	(3)
	Positive emotions	Positive emotions	Positive emotions
Time Lapse	0.0131*	0.0138*	0.0147*
	(0.00575)	(0.00563)	(0.00564)
	0.160	*0.169*	*0.179*
Period 1901 to 1927	0.0640	0.111	0.0860
	(0.314)	(0.332)	(0.331)
	0.0142	*0.0246*	*0.0191*
Period 1928 to 1954	0.254	0.278†	0.304†
	(0.167)	(0.168)	(0.172)
	0.122	*0.133*	*0.146*
Period 1955 to 1981	0.171	0.180	0.210
	(0.130)	(0.129)	(0.135)
	0.0993	*0.105*	*0.122*
Nobel in Chemistry		0.128	0.165
		(0.158)	(0.161)
		0.0683	*0.0883*
Nobel in physics		−0.171	−0.124
		(0.122)	(0.126)
		−0.0966	*−0.0700*
Theoretical work			−0.193
			(0.135)
			−0.0932
Female			−0.0153
			(0.374)
			−0.00271
N	222	222	222
*R*2	0.028	0.048	0.055
Adj. *R*2	0.010	0.021	0.020

Ordinary least squares (OLS) regressions. Standard errors (robust) in parentheses. Standardized beta coefficients in italics. Reference categories: Time period 1982 to 2008 and Nobel Prize in Physiology/Medicine

Numbers in italics refer to Standardized beta coefficients, which is stated in the corresponding table notes

â€ < .10; * < .05; ** < .01; *** < .001

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