A Social Network Based Approach to Analyzing Artistic Influences on American Stand-Up Comedians

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Abstract. A considerable amount of scholarly study has been done on the art of "Stand-Up" comedy, particular American Stand-Up, on its history and vaudevillian origins, and its impact on several fields such as teaching, public communication, politics, and culture. However, there is a striking absence of studies that quantitatively examine the origins and patterns of artistic influences on the work of American Stand-Up comedians. In this paper, we attempted to fill that gap. We analyzed artistic influence, an intrinsically unmeasurable variable, using a set of observable proxies. Using these proxies, we modeled artistic influences on American Stand-Up comedians as a social influence network and studied the diffusion of influence through this network. We found that chains of artistic influence on American Stand-Up comedians originated from times much older than the vaudevillian era of the late 1800s to early 1900s. Indeed, they originated from European writers of the late middle ages. We also found that an overwhelming volume (91.23%) of direct artistic influence on American Stand-Up comedians came from individuals who were at most two generations (50 years) older than the influenced comedians, and more than half (55.73%) of the direct influence came from individuals of the same generation. We found the total volume of artistic influence (direct and indirect) on the American Stand-Up comedians followed a pronounced Pareto pattern with 11.40% and 16.67% of influencers contributing respectively 79.64% and 90.06% of the total influence volume. We also found the social influence network of American Stand-Up comedians to exhibit "small-world" network behavior.

Keywords: stand-up comedy, artistic influence, social network, small-world network.

1 Introduction

1.1 Motivation

In the United States, laughter is serious business. By 2024, total revenue from comedy events in the United States was projected to surpass 3.4 billion dollars [1]. Stand-Up comedy (often referred to as "Stand-Up") is a huge part of this business. In 2023 alone, the Stand-Up tours of just nine contemporary US comedians generated a whopping quarter billion dollars in revenue from the sale of a staggering 2.7 million tickets across 537 performances [2]. Given its obvious commercial heft as well as its ability to

provoke public thought and discourse, a vast amount of scholarly research has been done on the art of Stand-Up as well as its economic and sociological impact. Studies have examined the content, vocabulary, sentence structure, prosody, and delivery style of individual Stand-Up comedians such the South African comedian Trevor Noah [3], American Stand-Ups Jerry Seinfeld and Steven Wright [4], as well as that employed by cross-section of all comedians [5][6]. Similarly numerous are studies on the role of Stand-Up in fields such as public opinion, politics, and culture [6][7][8]. Entirely absent from scholarly literature, however, are studies that quantitatively analyze the pattern of artistic influences on Stand-Up comedians, especially American Stand-Up comedians. In this paper, we attempted to address this gap via a social network theoretic approach. Specifically, 1) we attempted to define artistic influence (a stubbornly qualitative property) via a set of proxies which made it pliable for quantitative measurement; 2) We identified the people who were both direct and indirect influences on American Stand-Up comedians (both living and dead); 3) We examined patterns in the influence graphs of individual Stand-Up comedians; 4) We analyzed path length and clustering properties of the network of artistic influences for signs of small-world behavior.

1.2 Related Work

Stand-up comedy in America is considered to trace its influences back to the vaudevillian performances of the early 1900s. Reference [9] qualitatively examined the influence of American vaudeville industry on the development of the art of some of the earliest Stand-Up comedians and comedic stage performers such as Eddie Cantor, W.C. Fields, George Burns, and the Marx Brothers. Works such as [10] and [11] chronicled and described the evolution of American Comedy from the Vaudeville era of the 1900s to the 21st century. Additionally, [10] and [11] identified the major influencers of content, genre, vocabulary, and delivery style, and described how these aspects of comedy were transmitted from one generation of American Stand-Up comedians to the next. These studies presented a *qualitative* picture of the flow of artistic influence from the influencer to the influenced comedian. A *quantitative* examination of scholarly influence using a social network approach was done in [12], [13], and [14] in which the authors used social network theory to model and analyze the influence exerted by scholars on other scholars. In this set of three papers, the authors used the Yet Another Great Ontology (YAGO) data set which sourced its data from Wikidata which in turn is the central storage for data available on Wikipedia. In their studies, the respective authors considered a vast body of scholars. The data used by these studies spanned all eras from antiquity to contemporary, and extensive longitudinal analysis was performed by the authors on intra-era, inter-era, and accumulated-era scholarly influences. In our study, we focused singularly and deeply on the quantitative aspects of artistic influences on American Stand-Up comedians who lived during the late-1800s to the present time.
Specifically, we relied exclusively on the entries in the Wikipedia category *American_stand-up_comedians* and augmented them (wherever needed) with entries from the Wikipedia categories *19th-century_American_comedians*, *20th-century_American_comedians*, and *21st-century_American_comedians*. We found that accessing the data on individuals from Wikipedia using the Wikipedia-API yielded data on artistic

influence that were more current than available in the most recent release of YAGO (YAGO 4.5.0.1; release date: 19-July-2023) or similar ontological data sets which relied on Wikidata as their data source. Our data collection strategy is described in the *Methods* section. Ours was also a bottom-up approach where we started with the set of American Stand-Up comedians retrieved using the Wikipedia-API, and we traced the chains of influence "upward" from each comedian in this set, allowing the chain to branch out and dig into history as wide and deep as the data allowed. Another important highlight of our study that was missing from prior work on this topic was the evaluation of the network of artistic influences for signs of small-world-ness. Overall, our study was a greatly expanded version of [15]. While [15] studied artistic influences on a specific subset of American Stand-Up comedians who were the most popular as of end of 2023, in the present study, we covered *all* American Stand-Up comedians known to Wikipedia, along with their influencers, thereby making our dataset around 360% bigger than the one studied in [15].

2 Methods

2.1 Defining and quantifying artistic influence

A dry definition of the word "influence" is "the power or capacity of causing an effect in indirect or intangible ways". When examined in the context of artistic work such as the influence of a stand-up comedian A's work on that of B, we considered influence to mean the ability of A's work to be adopted by B in its entirety or merged with B's work in terms of subject-matter, category (a.k.a. the genre), vocabulary, sentence structure, prosody, and delivery style.

Given how stubbornly resistant to quantification are these qualities, a promising approach was to treat influence as a latent variable that has one or more observable counterparts that can be considered as proxies for influence. That is the approach we followed in our study. We carefully examined two kinds of influences as illustrated by the following examples taken from our data set: The American Stand-Up comedian John Mulaney was listed as an influence of another American Stand-Up comedian Taylor Tomlinson. In another instance, American Stand-Up comedian David Chappelle was listed as an influence on John Mulaney's work. In the first example, we assumed that John Mulaney was a "direct" influence on Taylor Tomlinson. In the second example, since Chappelle was listed as an influence on Mulaney, the question arose about whether Tomlinson was influenced not only directly by Mulaney, but also indirectly by Chappelle via Mulaney. In other words, was influence transitive? Transitivity of influence was an assumption made implicitly by all prior work on scholarly and artistic influences that we reviewed. In our work, we decided to examine the validity and implication of this crucial assumption before using it to quantify influences. In some areas of artistic influence such as genre, vocabulary, sentence structure, delivery medium, and delivery style, it seemed reasonable to assume that influence was transitive. But as highlighted in [11], influence was often *not* transitive in subject matter. The topics that interested artists and their audiences several generations ago may be of little to no interest to the current generation of artists and audiences.

Returning to our illustrative example, and to the extent that influence can be assumed to be transitive, we assumed that Chappelle was an “indirect” influence on Tomlinson. In general, we assumed that a comedian could be "indirectly influenced" by another comedian via one or more intermediate comedians. This was a crucial assumption, not the least because artistic influence was inherently impossible to quantify, but also given that in our data, Chappelle was also listed as a direct influence of Tomlinson. This fact led to the question of whether to ignore Chappelle’s indirect influence in favor of Chappelle’s direct influence on Tomlinson. We took the view that in such cases, *Chappelle influenced Tomlinson in two distinct ways*: via intermediate individuals such as Mulaney, and also directly. Our rationale was that Chappelle’s influence running via Mulaney, i.e. in the way Mulaney absorbed it, adapted it, built upon it and so on before transmitting it on to Tomlinson, may have modified its nature. This made the indirect influence of Chappelle on Tomlinson distinct from Chappelle’s direct influence on Tomlinson. As an aside, we also considered Mulaney’s own direct influence on Tomlinson’s art to be distinct from Chappelle’s effect running into Tomlinson via Mulaney. In the general case, we counted every simple distinct influence chain from an individual A to an American Stand-Up comedian Z that contained zero or more intermediate persons as a unique instance of influence that A exerted on Z’s work. In network-theoretic terms, we modeled all influences as a social network in which nodes represented persons and influences represented unweighted directed edges. If individual A influenced individual B, there was a directed edge from node A to node B. We defined the *total influence volume* of A on B as the number of simple paths running from A to B. Thus, the out-degree of node A was the total *direct influence volume* of A exerted by A on all individuals that A directly influenced. We also termed the group of nodes in the network that represented the set of American Stand-Up comedians as the *base social group*. We termed the total number of simple paths which were incident upon the base social group as the total influence volume on the base social group, and the total number of simple paths originating from a node A that terminated on nodes in the base social group as the *total influence volume of a single node* A on this group. We assigned the meaning employed in [16] to the terms “group” and “social group”. To analyze the social influence network for small-world phenomena as described in [17], and small-world-network properties as described in [18], we used the measures of shortest path length, average shortest path length and average clustering coefficient.

2.2 Building the Data Set

We used Wikipedia-API which is a Python language wrapper on the Wikimedia Foundation’s MediaWiki Action API to fetch all data needed to build the data set. Specifically, we started with fetching the set of all comedians in the Wikipedia category *American_stand-up_comedians*. Additionally, we fetched all comedians listed as Stand-Up comedians from the Wikipedia categories *19th-century_American_comedians*, *20th-century_American_comedians*, and *21st-century_American_comedians* and merged this set into the set from the category *American_stand-up_comedians*.

Using Wikipedia-API, the Python programming language and associated Regular Expressions libraries, we parsed the Wikipedia entry of each comedian in the base

social group to determine which individuals were listed as their influences. Often, influences were listed in the Influences section of the Wikipedia entry. But in some cases, they were (also) listed elsewhere in the entry. Working "upward" from each comedian in our base social group, we traced the chains of influencers. If an influencer was not part of the base social group, we fetched the Wikipedia entry for that influencer and repeated the influence scanning procedure for that influencer. We executed this process recursively until there were no further influencers listed in the Wikipedia entry of the individual. Often, Wikipedia entries of influencers mentioned comedians or people whom they influenced. This was especially true of major influencers such as Richard Pryor, Steve Martin, and Elaine May. Such "back-references" were often present not only in the Legacy section of the Wikipedia entry of the influencer, but also in other places in the entry. We pulled in all such influenced individuals mentioned in such back references and considered them for addition into the social network. While all comedians in the base social group were American Stand-Up comedians, we allowed influencers to have non-US nationalities and not be Stand-Up Comedians. The only two restrictions we placed on an influencer were that 1) they have written, directed, or performed at least one work of a humorous nature, and 2) they directly or indirectly influenced a comedian in the base social group. Thus, the direct and indirect influencers of the base social group came from occupations such as writing, directing, sketch or improv comedy performing, and talk-show hosting, just to name a few. In a few instances, we found influencers to be non-human entities such as Warner Bros. Cartoons and Mad Magazine which we dropped from our data set.

For each entry we fetched, in addition to noting their influences, we collected their dates of birth and death from their Wikipedia entry whenever these data were available. We split comedy pairs (e.g. Nichols and May), or troupes (e.g. Monty Python) into individual members and noted them separately as influencers on other individuals wherever the pair or troupe (as a whole) was listed as an influence. Similarly, influences on the whole pair or troupe were considered as influences on each member. We additionally traced the ancestral influences of each pair and troupe member individually so as not to leave out any influences who were unique to individual pair or troupe members.

2.3 What We Studied

Once the social network was built, we studied the diffusion of artistic influences in the following different ways:

- Presence of (and nature of) cycles and cliques of artistic influence (if any).
- Distribution of direct influence volume on the base social group. Identification of top-10 direct influencers of the base social group using out-degree-distribution.
- Distribution of birth-year-to-birth-year timespan measured in terms of number of generations between the comedians in the base social group and their direct influencers. We assumed one generation was 25 years.
- Distribution of total (i.e. direct and indirect) influence volume on the base social group as measured by the number of simple paths originating from an influencer and

terminating on one or more comedians in the base social group. Identification of top-10 'super-influencers' based on their total influence volume on the base social group.
- Identification of longest influence chains and corresponding influencer-comedian pairs.
- Distribution of shortest path lengths, average shortest path length, and clustering behavior, specifically, the average clustering coefficient of the influence network for signs of small-world phenomena, and small-world network properties.

2.4 Tools Used

For processing the data set and performing network analysis on it, we used Python 3.11.6 and several Python libraries. Chief among these libraries were numpy 1.26.3, pandas 2.1.4, csv 1.0, json 2.0.9, re 2.2.1, and networkx 3.2.1. For plotting, we used matplotlib 3.8.2 and seaborn 0.13.1. Additionally, we used Cytoscape 3.10.1 for rendering graphs.

2.5 Limitations Of Our Study

Wikipedia follows a policy-driven process for verifying information and citations. This policy is implemented by a community of editors, moderators, and software bots. Numerous topic-based studies have revealed that information on Wikipedia forms a good, if not a complete, representation of reality [19], that it is resilient to tampering [20][21], and reasonably accurate [22]. Nevertheless, given that we relied exclusively on data from Wikipedia, our data set was exposed to bias arising from errors of omission and incorrect or missing attributions. To illustrate, about 80% of the comedians in the base social group were found to not have any influences listed on their Wikipedia pages.

A limitation worth highlighting (was that the data on influences on Wikipedia mentioned neither the current strength of an influence (especially with respect to other influences on the comedian), nor its temporal distribution. To illustrate, Comedian B might have been a big influence on Comedian A in the past but currently not so much. Or worse still, Comedian A might have altogether changed their mind about B's influence on their work. None of these facts were reflected in data on influences on Wikipedia. Thus, we assumed a simple (perhaps too simple) binary encoding of B's influence on A. The influence was either present or not present as codified by a presence or absence of a directed edge from B to A.

At any rate, such realities made our social influence network incomplete and at best, a proxy for the real, unknown network of artistic influences on American Stand-Up comedians.

3 Results

3.1 The Social Influence Network

Our data set building procedure yielded a set of 1532 American Stand-Up comedians which formed the base social group. Of these 1532 individuals, 1208 comedians did not influence, nor were they influenced by, any other individual. These 1208 comedians were isolated nodes in the social network. Of the remaining 324 comedians, 239 comedians were influenced by at least one individual and 85 comedians influenced at least one other individual although they themselves weren't influenced by anyone. The base social group of 1532 American Stand-Up comedians, together with their direct and indirect influencers constituted a social network of size 1710 nodes and 1280 directed edges (Fig. 1).

Fig. 1. The social influence network of 1532 American Stand-Up comedians.

3.2 Cycles and Cliques

Except for a 2-cycle between American Stand-Up comedians Jerry Seinfeld and Steve Martin, and another 2-cycle between the Canadian writer and humorist Stephen Leacock and the American humorist Robert Benchley, we found no other cyclical patterns of artistic influences. And thus, no other cliques either.

3.3 Direct Influencers of the Base Social Group

The direct influencers of the base social group formed a group of 295 individuals. A total of 1055 directed edges originated from this group of 295 influencers and terminated on nodes in the base social group. We considered this number to be a measure of the total "influence volume" exerted by the influencers on the base social group. An out-degree-distribution plot for the group of 295 influencers that considered only these 1055 edges revealed an exponential-like long-tail pattern (Fig. 2 and Table 1), and thus a cumulative distribution of influence volume on the base social group revealed a Pareto-like pattern (Fig. 3) with only 3.39% of direct influencers of the base social group

generating nearly 25% (260 edges) of the direct influence volume, 10.51% of direct influencers generating nearly 50% (525 edges) of direct influence volume, and 29.49% of direct influencers generating nearly 75% (791 edges) of direct influence volume on the base social group. The top-10 direct influencers of base social group (Table 2) influenced 16.98% of the comedians in the base social group while contributing 24.64% (260 edges) of the direct influence volume incident upon this social group.

Artistic genres, vocabulary, sentence structure, prosody and presentation style evolve across generations of artists. We wanted to find out whether American Stand-Up comedians found the work of artists who preceded them by multiple generations still relevant enough for them to act as *direct* influences on their art. To find this out, we analyzed the distribution of birth-year-to-birth-year timespan measured in terms of number of generations between the comedians in the base social group and their direct influencers.

Of the 1055 edges incident upon the base social group, 95.07% (N=1003) edges corresponded to an influencer-comedian pair in which both the influencer and the corresponding comedian in the base social group whom they influenced had valid birth *year* data available. We found that in an overwhelming majority (91.23%) of these influences, the influencer was born within 2 generations (50 years) of their "protege" (Fig. 4). Table 3 gives additional details about this distribution.

The data also indicated an implicit predisposition of American Stand-Up comedians to draw direct influence from individuals from within their own generation as illustrated by the fact that more than half (55.73%) of the direct influence volume of 1003 edges on the base social group came from within the same generation (Fig. 4).

The tails of this distribution also merit a mention. At the lower end of the spectrum were a set of 18 American Stand-Up comedians (with direct influence volume of 23 edges incident upon them) who were influenced by individuals who were born after them albeit within the same generation (Table 4). Notable among this set were American comedians Bill Hicks, Jorie Remus, and Mort Sahl who were born a decade or more after Lewis Black, and Phyllis Diller, whose art they influenced. At the other end of the spectrum was a set of 8 American Stand-Up comedians (with a direct influence volume of 15 edges incident upon them) who were influenced by individuals who were born at least 3 generations (75 years) prior to the influenced comedian (Table 5).

Notable among this set were the American Stand-Up comedians Bill Hader (born: 1978) and Leo Allen (born: 1972) who were directly influenced respectively by the Russian novelist Fyodor Dostoevsky (1821–1881), and by Spanish writer and novelist Miguel de Cervantes (1547–1616), the latter being best known for his novel *Don Quixote*.

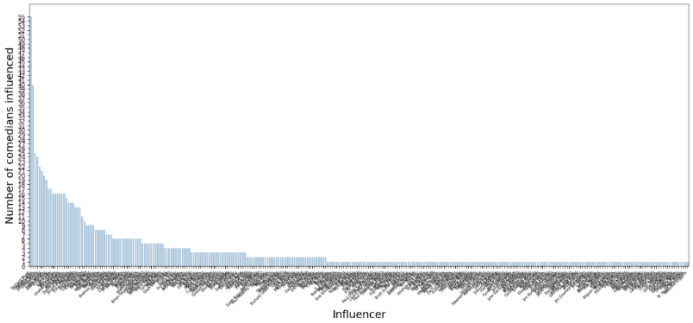

Fig. 2. Out-degree distribution of direct influencers of American Stand-Up Comedians.

Table 1. Distribution of the direct influences on American Stand-Up Comedians

Direct influencers of the Base Social Group	**Number of Comedians in the Base Social Group Directly Influenced by an Influencer**						
N	**M**	**SD**	**Min**	**25%**	**50%**	**75%**	**Max**
295	3.58	5.72	1	1	1	3	55

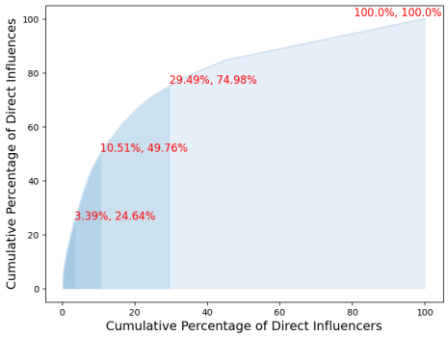

Fig. 3. Cumulative percentage influence volume of direct influencers of American Stand-Up Comedians versus percentage of direct influencers.

Table 2. Top-10 direct influencers of American Stand-Up Comedians

Rank	**Influencer**	**Number of Comedians in the Base Social Group Directly Influenced**	**Percentage of Comedians in the Base Social Group Directly Influenced**	**Percentage of Direct Influence Volume on the Base Social Group**
1	Richard Pryor	55	3.59	5.21
2	George Carlin	40	2.61	3.79
3	Woody Allen	25	1.63	2.37
4	Johnny Carson	24	1.57	2.27
5	Lenny Bruce	22	1.44	2.09
6	Bill Cosby	21	1.37	1.99
7	Steve Martin	20	1.31	1.9
8	Eddie Murphy	19	1.24	1.8
9	Chris Rock	17	1.11	1.61

10	Eric Idle	17	1.11	1.61
	TOTAL	**260**	**16.98**	**24.64**

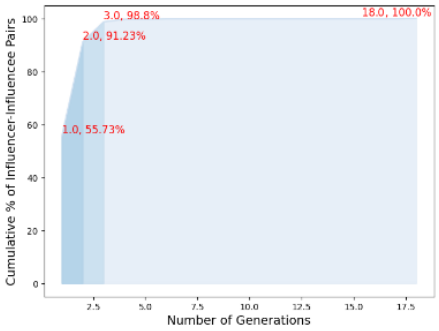

Fig. 4. Cumulative distribution of birth-year-to-birth-year timespan measured in number of generations between a comedian in the base social group and their direct influencer.

Table 3. Distribution of birth-year-to-birth-year timespan (in number of generations) between an American Stand-Up Comedian and their direct influencer.

Influencer-comedian pairs	**Birth-Year-to-Birth-Year Timespan (in num generations)**						
N	**M**	**SD**	**Min**	**25%**	**50%**	**75%**	**Max**
1003	1.06	0.85	-0.52	0.6	0.92	1.36	17.16

Table 4. Distribution of birth-year-to-birth-year timespan (in years) between an American Stand-Up Comedian and their direct influencer (influencer born before influenced comedian).

Influencer-comedian pairs	**Birth-Year-to-Birth-Year Timespan (in years)**						
N	**M**	**SD**	**Min**	**25%**	**50%**	**75%**	**Max**
23	-4.87	3.44	-13.0	-6.5	-4.0	-2.0	-1

Table 5. Distribution of birth-year-to-birth-year timespan (in years) between an American Stand-Up Comedian and their direct influencer (influencer born >= 75 years before influenced comedian).

Influencer-comedian pairs	**Birth-Year-to-Birth-Year Timespan Measured (in years)**						
N	**M**	**SD**	**Min**	**25%**	**50%**	**75%**	**Max**
15	109	90.37	75	78	81	87	429

3.4 All Influencers of the Base Social Group

We repeated the above analysis to also include individuals who indirectly influenced comedians in the base social group. This larger social group was effectively the union of ancestor-graphs of all comedians in the base social group and represented a set of 342 nodes in the social network. There were 375992 unique simple paths from this group of 342 influencers to the comedians in the base social group. This set of 375992 simple paths formed (what we termed as) the total influence volume on the base social group. The total influence volume by influencer revealed a highly skewed distribution

and a pronounced Pareto pattern (Fig. 5, Tables 6 and 7) with just 11.40 % and 16.67% of influencers contributing respectively 79.64% and 90.06% of the total influence volume on the base social group. Also, this time, a very different group of 'super-influencers' emerged with the top-10 super-influencers (Table 8) constituting 2.93% of total influencers and contributing 36.27% of total influence volume on the base social group. The influence cascade of the English novelist and social critic Charles Dickens (Fig. 6) lying at position 10 provides a visual feel for the scale of direct and indirect influences of the influencers in the top-10 list.

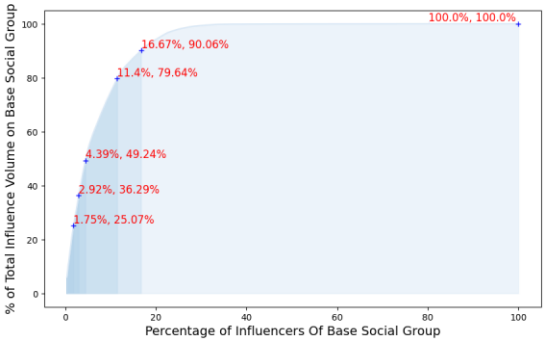

Fig. 5. Cumulative percentage of total influence volume incident on American Stand-Up Comedians versus percentage of influencers.

Table 6. Distribution of direct plus indirect influencers of American Stand-Up Comedians.

All influencers of the Base Social Group	Number of Comedians in the Base Social Group Directly or Indirectly Influenced by an Influencer						
N	M	SD	Min	25%	50%	75%	Max
342	47.96	66.91	1	1	3	100	203

Table 7. Distribution of the total influence volume on American Stand-Up Comedians.

Simple Paths To the Base Social Group	Number of Simple Paths From Influencer to an American Stand-Up Comedian in the Base Social Group						
N	M	SD	Min	25%	50%	75%	Max
375991	1099.39	2845.26	1	1	3	424.25	22525

Table 8. Top-10 influencers of the base social group by total incident influence volume.

Rank	Influencer	Number of Comedians in the Base Social Group Directly or Indirectly Influenced	Percentage of Comedians in the Base Social Group Directly or Indirectly Influenced	Total Influence Volume on the Base Social Group	Percentage of Total Influence Volume on the Base Social Group
1	Dan Leno	166	10.88	22525	5.99
2	Fred Allen	198	12.98	16081	4.28
3	Mort Sahl	203	13.3	14707	3.91
4	Stan Laurel	164	10.70	14320	3.81
5	Oliver Hardy	164	10.70	14320	3.81

6	William Shakespeare	164	10.70	12303	3.27
7	Henry Fielding	164	10.70	10545	2.80
8	Tobias Smollett	164	10.70	10545	2.80
9	Charles Mathews	164	10.70	10544	2.80
10	Charles Dickens	164	10.70	10544	2.80
	TOTAL	**1715**	**112.41**	**136434**	**36.27**

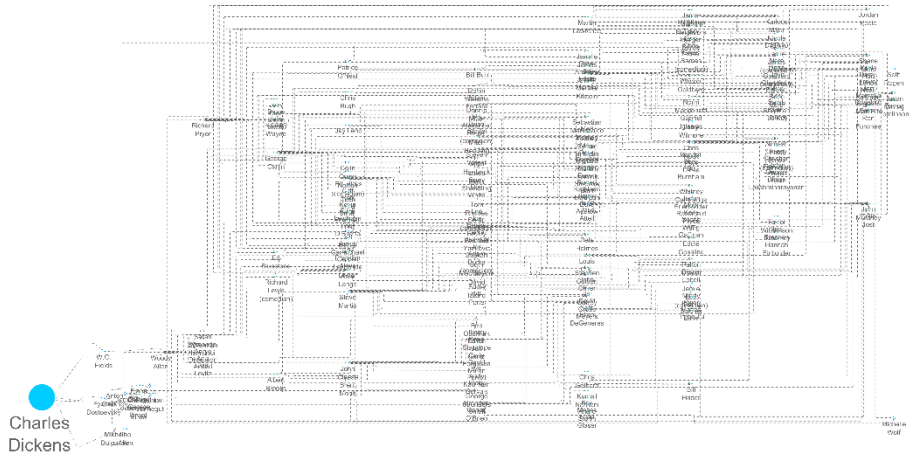

Fig. 6. All simple paths from Charles Dickens to American Stand-Up comedians that Charles Dickens influenced directly or indirectly.

3.5 Influence Chains

An analysis of all simple paths from an influencer to a comedian in the base social group revealed a set of 45 longest chains of influence of length 16 each that started from the English novelist and dramatist Henry Fielding (1707–1754), the English theater manager and comic actor Charles Mathews (1776–1835), the Scottish surgeon, novelist, critic, and playwright Tobias Smollett (1721–1771), the English biographer and literary critic John Forster (1812–1876), and William Shakespeare (1564 – 1616), and which terminated on the American Stand-Up comedians Hasan Minhaj, Michelle Wolf, Seth Rogen, and Taylor Tomlinson. In these chains, we also noted American filmmaker, actor, and comedian Woody Allen's role in "transmitting" influences from writers to American Stand-Up comedians (Fig. 7). The distribution of simple path lengths from all direct and indirect influencers of the base social group to members of the base social group showed a moderately long tailed pattern with most of the mass concentrated within path lengths of 1 through 8 (Fig. 8 and Table 9).

An analysis of shortest path lengths from any influencer to any comedian in the base social group revealed that almost all (99.79% of) influencers were able to influence the work of American Stand-Up comedians directly or indirectly via at most 5 intermediate comedians (Fig. 9 and Table 10).

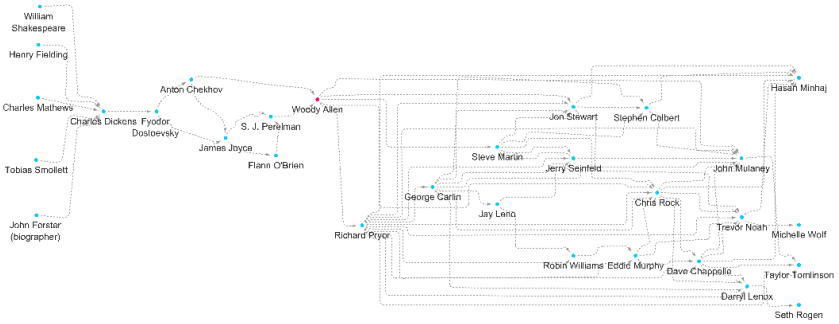

Fig. 7. The subgraph shows the 45 longest paths of influence of length 16 each.

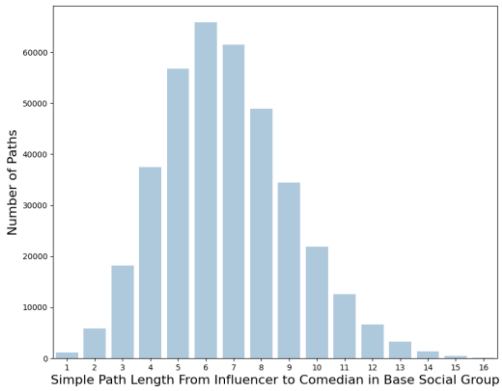

Fig. 8. Distribution of simple path lengths from influencer to American Stand-Up comedian

Table 9. Distribution of simple path lengths from influencer to American Stand-Up comedian

Simple Paths Incidents Upon the Base Social Group	**Length of Simple Path From Influencer to an American Stand-Up Comedian in the Base Social Group**						
N	**M**	**SD**	**Min**	**25%**	**50%**	**75%**	**Max**
375992	6.73	2.33	1	5	7	8	16

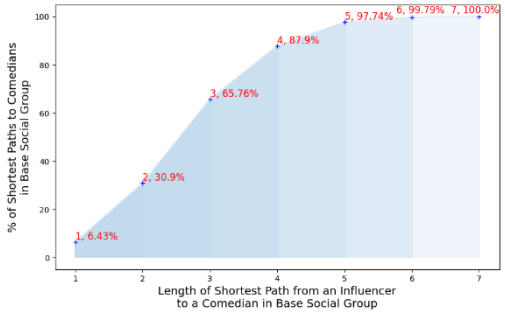

Fig. 9. Cumulative percentage of shortest path lengths to American Stand-Up comedians

Table 10. Distribution of shortest path lengths from influencer to American Stand-Up

Shortest Paths Incidents Upon the Base Social Group	**Length of Shortest Path From Influencer to an American Stand-Up Comedian in the Base Social Group**						
N	**M**	**SD**	**Min**	**25%**	**50%**	**75%**	**Max**
16401	3.11	1.15	1	2	3	4	7

3.6 Small-World Network Analysis

The preceding results on shortest path lengths indicated that artistic influences on American Stand-Up comedians exhibited signs of small world phenomena as described in [17]. It led us to investigate if the social influence network of American Stand-Up comedians exhibited "small-world" network properties as defined in [18]. We considered the 239 comedians in the base social group having ancestor graphs of influence. From this "population", we drew 100 random samples of 30 nodes each (with replacement). For each random sample, we constructed the union of their ancestor graphs. For each such graph, we calculated the average shortest path length, and the average clustering coefficient, and we calculated and stored for later analysis the average of the 100 such averages and the corresponding standard deviations. Next, we transformed each of the 100 graphs into a random graph of equivalent complexity using the rewiring procedure used in [18]. This procedure preserves the number of nodes, edges, and the average out-degree of the original graph. In the random rewiring procedure, we introduced a check to ensure that for any newly rewired influence edge, when the source node's birth year and the destination node's death year were both available, the destination's death year was after the source's birth year plus 18 years. This ensured that the randomly rewired graph did not contain influences that would be impossible or highly unlikely. We once again calculated the average shortest path length and the average clustering coefficient of each random graph and calculated their respective means and standard deviations (Table 11). Finally, we used the Welch's t-test to compare the two sets of means. There was a significant effect for average shortest path length, $t(100) = -93.77$, $p < .001$, with average shortest path length of the non-random graph being smaller than that of the random graph. There was also a significant effect for average clustering coefficient, $t(100) = 67.29$, $p < .001$, with average clustering coefficient of the non-random graph being larger than that of the random graph. These results led us to conclude that the artistic influence networks of American Stand-Up comedians exhibited a "small-world" network like behavior.

Table 11. Average shortest path length and clustering of social influence networks of American Stand-Up comedians, versus, respective measures in random graphs of equivalent complexity.

N = 100	**Avg. Shortest Path Length**	**Avg. Clustering Coefficient**
Non-random graph	M = 2.72, SD = 0.05	M = 0.07, SD = 0.007
Random graph	M = 5.62, SD = 0.30	M = 0.02, SD = 0.0018

4 Summary

The current state of American Stand-Up is the evolutionary outcome of over a century's worth of trial-and-error done by hundreds of stage-performers, comics, writers, directors, and producers. Stand-up comedy in America is considered to trace its influences back to the vaudevillian performances of the early 1900s. We showed that the arrows of artistic influence may have originated much deeper in history with the longest observed influence chains originating from writers from late middle age Brittain and Spain. In this work, we kept our attention sharply focused on studying the patterns of influences on the work of American Stand-Up comedians. For this group, we found the influence structure followed a pareto-like pattern with most of the influence on this group coming from a comparatively small set of individuals. We found that an overwhelming volume of direct artistic influence on American Stand-Up comedians came from individuals who were at most two generations older while most of this influence came from people of their own generation. We also found the influence graphs of the American Stand-Up comedians exhibited distinct small-world network behaviors as evidenced by a much smaller average shortest path length and a larger average clustering coefficient as compared to random graphs of equivalent size and complexity. We hope the results and techniques described in this paper prove useful to students of American stand-up comedy and its history by supplying a quantitative perspective to the body of material written about those topics. A natural extension of this study is to apply the techniques used in this study to analyze the structural patterns of artistic influences on non-US Stand-Up comedians or on all “Stand-Ups”. Other promising extensions are to carry forward these techniques to the study of artistic influence in other branches of comedy, and to other artistic fields such literature, drama, music, sculpture, and painting.

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