

# Ghuluww (Exaggeration) in al-Kāfī: A Data-Analytic Approach

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## Abstract

The focus of the present study is the concept of *ghuluww* (to transgress a boundary) tendency and the *ḥadīth* content ascribed to this tendency. We designate *ḥadīth* transmitters that were labelled as the subscribers of the idea of *ghuluww*, called *ghulāt* (sing. *ghālī*; transgressive Shī'īs), who lived in the early Islamic era, especially during the Imamates of the fifth and sixth Shī'ī Imāms, Muḥammad b. Alī al-Bāqir (d. 114/733) and Jafar b. Muḥammad al-Sādiq (d. 148/765). We examine such associations considering the 5th/11th-century bio-bibliographical dictionaries.

In modern scholarship, several ideological tenets have been ascribed to *ghulāt*. We apply a data-analytic approach as well as statistical techniques to verify whether such ideological tenets can be found back in early Imami hadith books by examining those *ḥadīths* related by transmitters accused of *ghuluww*.

Based on the integration of a Twelver Shī'ī (Imāmī) *ḥadīth* collection of the 4th/10th Century, *al-Kāfī fī ilm al-dīn* compiled by Muḥammad b. Yaqūb al-Kulaynī (d. 329/941), on the one hand, and the alleged *ghālī* labels mentioned in the Imāmī bio-bibliographical literature from the 5th/11th century, on the other, we analyse the correlations between the contents of *ḥadīths* provided by al-Kulaynī and the allegations of *ghuluww* in the transmission chains (*isnāds*) of these *ḥadīths*. We analyse if there is a particular genre of *ḥadīths*, considered as *ghālī* in academic scholarship, in which the presence/influence of the *ghuluww* tendency is meaningfully more than the others. Also, we analyse whether there exists a particular genre of *ḥadīths*, considered *ghālī* in academic scholarship, where there is a statistically significant community-transmission among the *ghālī* transmitters. Our results show that, as far as the *isnāds* and text (*matns*) of *ḥadīths* found in *al-Kāfī* are concerned, there is neither statistically significant presence of *ghālī* transmitters nor community-transmission of what is considered as the *ghālī* genre.

## Introduction

*Ghuluww* (to transgress a boundary) is an Islamic term, used in Qur'an to mean transgressing a given boundary or mark and going beyond a limit.<sup>1</sup> It has been used in the

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<sup>1</sup> In academic studies, the term "*ghuluww*" has been translated into English in various ways. Wadād al-Qāḍī considers extremism to be an erroneous translation and suggests exaggeration as the most correct translation for this term. See al-Qāḍī, "The development of

early heresiography and historiography, possibly dating back to the first/seventh century.<sup>2</sup> The focus of the present study is, however, a group of people active during the 2nd/8th century, who were designated by the later Imāmī bio-bibliographical dictionaries of the 5th/11th century as *ghulāt* (sg. *ghālī*). Many of these have been among the disciples of Muḥammad b. ‘Alī al-Bāqir (d. 114/733) and his son Ja‘far b. Muhammad al-Šādiq (d. 148/765), the fifth and the sixth Shī‘ī Imāms; this tendency has not only been mentioned in some of the earliest Shī‘ī heresiographies,<sup>3</sup> but their figures were also discussed in the later bio-bibliographical literature of the 4th/10th and 5th/11th centuries (also under various other related designations, such as *Mufawwiḍa* or *Tayyāra*). There is a confusion, both in the early texts and in the academic scholarship, as to what constitutes *ghuluww* and what are the main ideological tenets of *ghulāt*. Our work proposes and applies a data-analytic approach to verify some of the hypothesis inspired the academic scholarship on *ghuluww* and provides a means to rigorously address some of the confusion and disagreement in the ongoing research.

Several studies in academic scholarship have delved into the history and concept of *ghuluww* during the first four centuries of Islam.<sup>4</sup> An analysis of these academic

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the term *Ghulāt* in Muslim literature with special reference to the Kaysāniyya", in Etan Kohlberg (ed.), *Shi'ism* (2003): 169-194. . Sean W. Anthony suggests "to transgress a boundary" as the English translation of *ghuluww*, which is consistent with not only its Quranic application but also the relativistic use of the term through history. See Anthony, Sean W., "Ghulāt (extremist Shī‘īs)", in: *Encyclopaedia of Islam, THREE*, Kate Fleet, Gudrun Krämer, Denis Matringe, John Nawas, Devin J. Stewart (eds.), Consulted online on 30 August 2023 <[http://dx.doi.org/10.1163/1573-3912\\_ei3\\_COM\\_27473](http://dx.doi.org/10.1163/1573-3912_ei3_COM_27473)>

<sup>2</sup> See, e.g., the designation of Saba‘iya among the followers of Mukhtar al-Thaqafi by Abu Mikhnaḥ, related by Tabari; cf. Wadad al-Qadi’s analysis of the first century Ghulat .

<sup>3</sup> See Nowbakhti and Qummi; Hodgson , al-Qadi and Bayhom-Doua analysed and dated these mentions of Ghuluww; see Section 3 for a brief review of their work.

<sup>4</sup> For some instances of academic studies on the development and history of *ghuluww*, see M. A. Amir-Moezzi, *The spirituality of Shi‘i Islam. Beliefs and practices*, London 2011; Mushegh Asatryan, *Controversies in Formative Shi‘i Islam: The Ghulat Muslims and Their Beliefs* (Bloomsbury, 2016); *idem.*, An early Shī‘ī cosmology. *Kitāb al-ashbāḥ wa-l-aẓilla* and its milieu, *SI* 110 (2015): 1–80; *idem.*, Shiite underground literature between Iraq and Syria. *The Book of shadows* and the history of the early *ghulāt*, in Y. Tzvi Langermann and Robert G. Morrison (eds.), *Texts in transit in the pre-modern eastern Mediterranean* (Philadelphia 2016): 128-61; Anthony, The legend of ‘Abdallāh ibn Saba’ and the date of *Umm al-Kitāb*, *JRAS* 21 (2011): 1–30; *Idem.*, Kaysāniya, *Elr*; *Idem.*, *The caliph and the heretic. Ibn Saba’ and the origins of Shi‘ism* (Leiden, 2012); *idem.*, The Meccan prison of ‘Abdallāh b. al-Zubayr and the imprisonment of Muḥammad b. al-Ḥanafiyya, in M. A. Pomerantz and A. Shahin (eds.), *The heritage of Arabo-Islamic learning. Studies presented to Wadad Kadi* (Leiden 2015), pp. 3–27; Tamima Bayhom-Daou, The second-century Šī‘ite *ghulāt*. Were they really gnostic? *J AIS* 5 (2003–4): 13–61; *idem.*, The imam’s knowledge and the Quran according to al-Faḍl b. Shādhān al-Nīsābūrī (d. 260 A.H./874 A.D.), *BSOAS* 64 (2001): 188–207; Patricia Crone, *The nativist prophets of early Islamic Iran. Rural revolt and local Zoroastrianism*, Cambridge 2012; Patricia Crone, The significance of wooden weapons in the revolt of al-Mukhtar and the Abbasid revolution, in Ian Richard

investigations reveals that the concept of *ghuluww* in the early Islamic era not only is marked by inconsistency but also has mixed connotations of negative and pejorative as well as positive and complimentary.<sup>5</sup> *Ghuluww* has been categorised in diverse beliefs such as the concealment (*al-ghayba*) of the Imām instead of his death,<sup>6</sup> The belief in the return of Imām (*al-rajʿa*),<sup>7</sup> “the continuation of divine revelation (*waḥy*) and inspiration (*ilhām*) after the prophet Muḥammad’s death”, the Qur’ān’s corruption and suppression (*taḥrīf*); the Imāms’ “possession of a preternatural knowledge of the unseen (*ʿilm al-ghayb*)”, the primacy of the esoteric interpretation of the Qur’ān (*taʿwīl*); the transmigration of souls (*tanāsukh*); the inherence of the divine in humans (*ḥulūl*); and the delegation (*tafwīd*) of divine powers to the Imāms. It is believed that

The classical categorization of beliefs known as "ghuluww" displayed variations among different treatments within the field of heresiology. Notably, Imāmī Shīʿa heresiographers and theologians frequently enumerated the following concepts:

- The belief in the return of Imāms and/or the righteous deceased at the culmination of time (*al-rajʿa*, *rajʿat al-amwāt*).
- The notion of the occultation of the future eschatological saviour (*al-ghayba*).
- The continuation of divine revelation (*waḥy*) and inspiration (*ilhām*) subsequent to the demise of the Prophet Muḥammad and/or the belief in the true Qur’ān’s corruption and suppression (*taḥrīf*).
- The possession of preternatural knowledge of the unseen by the Imāms and/or their followers (*ʿilm al-ghayb*).
- The primacy of an esoteric interpretation of the Qur’ān (*taʿwīl*).
- The transmigration of souls (*tanāsukh*).
- The concept of the inherent presence of the divine within humans (*ḥulūl*).
- The delegation (*tafwīd*) of divine powers to the Imāms.

Halm rooted early Shiʿi Ghuluww in gnosticism. He held that early Shiʿi Ghuluw borrowed their antinomianist theological tenets from gnosticism and hence held Imams as deities who revealed higher knowledge and light. This implied that early Ghulat had distinct views on imams, on the body and the soul (e.g., in transmigration of souls and rejecting the day of resurrection) and on legal matters (e.g., on denying the necessity of rituals such as fasts and

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Net- ton (ed.), *Studies in honour of Clifford Edmund Bosworth* (Leiden 2000), 1:174–85; Amikam Elad, *The rebellion of Muammad al-Nafs al- Zakiyya in 145/762*, Leiden 2016; Yaron Friedman, *The Nuayr-Alaws*, Leiden 2010;

<sup>5</sup> See Anthony

<sup>6</sup> Al-Qāḍī, "The development of the term Ghulāt", pp. 169-194.)

<sup>7</sup> See Ibid.

prayers). This view of Halm has some support in the later Firq literature . Al-Qadi argues that the concepts of ghuluww underwent a number of transformations; while the first century ghulat merely believed in the concealment and return of their leaders, these tendencies were acquired by the mainstream community. Hence, the term ghuluww had to undergo a transformation and was used to refer to more extreme ideas that deified the imams.

Hodgson argued that the ideological views of early Ghulat may be exaggerated in the firq literature, in order to distinguish them from the theological tenets that later received wide acceptance from the mainstream community. Bayhom took Hodgson's argument a step further and showed that the gnostic theological ideas were ascribed to Ghulat at a later stage and there is no historical basis to assume that the early Ghulat had such a different theological basis than the mainstream community. She argues that gnostic esotericism was superimposed at a later stage on the messianic ghuluww (often connected to militant movements such as that of Muhammad b. Abdullah, also known as al-Nafs al-Zakiyyah and Muhammad b. Miqlas, also known as Abu al-Khattab) to project more distance between the gnosticist and the mainstream community. In her theory, much of the deification and ascription of prophet-hood to imams and ghālī leaders to ghālī sects were the products of later formalisation of ghuluww. Our analysis of *al-Kāfī's ḥadīths* corroborates Bayhom's findings; we do not find any of the theological ideas ascribed to *ghulāt* having a significantly different distribution among the known ghālī transmitters compared to others.

Our research hypothesis considers the distinction between *ghuluww* and moderate genres postulated by some of the academic scholarship. Such a distinction assumes that certain genres, mostly concerned with the supernatural power and knowledge of Imams, were clear markers of the ghālī tendency and were commonly transmitted among them. We translate this research hypothesis into the following research questions:

1. Is there a sequence of *ḥadīths* in which the presence/influence of the individual *ghālī* transmitters is meaningfully more than the average of the entire *al-Kāfī*?

The concept of "sequence" in this, and the following research questions, refers to a fixed number of neighbouring *ḥadīths*; we use the concept of sequence, in order not to rely on *al-Kāfī's* variable-sized chapters, whose varying length may be a threat to the validity of our results. We analyse the possible consequences of this decision in the design of our experiments later on. We measure the influence of the ghālī transmitters by measuring the number of *ḥadīths* in whose transmission chains there is at least one ghālī transmitter.

2. Is there a sequence of *ḥadīths*, in which the community-transmission of *ḥadīth* among the *ghulāt* is meaningfully more than the average of the entire *al-Kāfī*?

We measure the influence of the ghālī transmitters by examining chains of transmissions in which a ghālī transmitter relates from another ghālī transmitter versus those chains in which non-ghālī transmitters relate from ghālī transmitters and vice versa.

The answers to these questions are analysed against the common findings of academic scholarship for correlation. Namely, we check whether those sequences designated by our data-analytic results match the genres typically associated with *ghuluww*.

Below we summarise a general theory that has support in the data analysis performed in the remainder of the paper.

In the remainder of this paper, we review the body of the literature on *ghuluww* and position our research within this body in Section 3. We specify our methodology and detail the design of our experiments in Section 4. We present the results of our analysis and discuss them in Section 6 by first reviewing the data and then manually studying through the body of *ḥadīths* resulting from our analysis. At the end of the same section, we also discuss the threats to validity and the measures we took to mitigate them as well as the direction of future studies that may be used to address them further.

For the sake of reproducibility and for future use, we have made a lab package comprising the data and software used in our research available at the following address:

<https://github.com/ghuluwwproj/alkafi>

## Landscape of Ghuluww

Supported by our data analysis results, the landscape of *ghuluww* seems very diverse and closely intertwined with the mainstream community: the early Shī community in the 2nd and early 3rd century was a mix of different tendencies without clear theological borders between ghālī and moderate; many ghālī transmitters were living with and participating in the mainstream community relating much of the mainstream texts. It is, hence, difficult to find any genre of *ḥadīths* that can be clearly labelled as ghuluww or has a characteristic of ghālī community transmission.<sup>8</sup>

The clear distinction between and many of the labels of *ghālī* and moderate attached to transmitters are artefacts of the later (late 3rd - 5th) socio-political necessities. The leaders of the later community felt the need to distance themselves from and extradite the outspoken part of the community that posed the threat of attacks by the Sunni political

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<sup>8</sup> Probably, this is also exacerbated by the filter applied by al-Kulayni; he did not trust those exclusively ghuluww content that we see back in the heritage of Nuṣairī authors.

power.<sup>9</sup> This isolated part of the community developed a separate body of literature around some earlier archetype figures.<sup>10</sup>

## Methodology

Our research methodology comprises the following three steps:

- Digitising information about ghuluww transmitters in the major Shi'i bio-bibliographical dictionaries; to verify the digitised data we did two independent rounds of encoding and cross-checked the two to remove any incomplete information or inaccuracy regarding hadith transmitter. For each transmitter, we recorded their name, their various designations, link to the texts in bio-bibliographic literature, as well as any the text indicating the accusation of ghuluww mentioned in them;
- Digitising isnad information in al-Kāfi: we digitised the isnad information and identified the transmitter in each isnad chain

## Pilot Study

As a pilot study and to define and refine our research questions, we made a few manual case studies into the *ḥadīths* of *al-Kāfi* transmitted by the leading figures associated with the moderate tendency and contrasted them with the *ḥadīths* of the ghālī tendency. The purpose of the pilot study was to find whether there is any pronounced difference between the content (matn) and the transmission chains (isnād) of these two categories of *ḥadīths*. Our initial findings indicated that the distinction is not significant and this motivated our research questions to establish or refute this observation in a larger scale across al-Kāfi. The data and a summary of our pilot study can be found in our public lab package .

## Experiment design

Our goal is to identify the sequence of *ḥadīths* transmitted by the ghālī community and we used data analytics to identify them. We consider two types of sequences to answer our two research questions: (1) those sequences of *ḥadīths* where *ghālī* transmitters were

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<sup>9</sup> This can also explain the inconsistency in the criteria for ghuluww and the labelling of ghālī observed in our raw bio-bibliographical data by the different figures living in different socio-political milieu; particularly, those living in areas, such as Qum, with a strong threat from Sunni rulers, such as those in Ray, applied more strict criteria and accused more ḥadīth transmitters of ghuluww. See, for example, an-Najashi, p. 185 and p. 329 and Ibn-Ghada'irī, pp. 66-67.

<sup>10</sup> See the analysis of Kitab al-Haft and the work of the “aḏilla Group” by M. Asatryan ; we briefly review this work in the remainder of the paper.

influential in their transmission, and (2) a sequence in which there is a significant community transmission among ghālī transmitters.

We use the concept of a *sequence* as a proxy to the semantically-related matn. A ḥadīth  $h$  is present in a number of sequences to its right and left, denoted by  $HS(h)$ . For sequence size  $W$ , the size of  $HS(h)$  is also  $W$ . The exceptions to this rule are ḥadīths that appear close to the beginning or the end of the book, which appear in fewer than  $W$  sequences. This is illustrated in Figure 1. For each ḥadīth, denotes the set of sequences that include that particular ḥadīth. In the remainder of this section we will look at RQ1 and RQ2 in order.

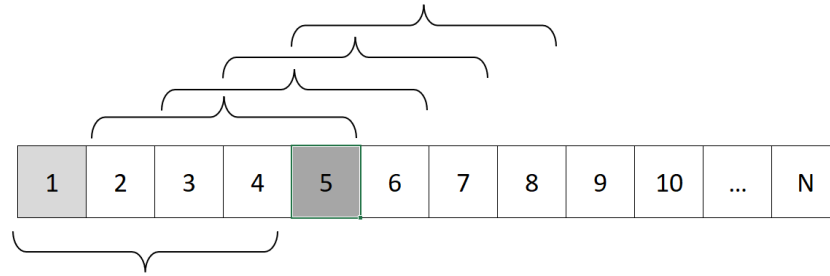


Figure 1. Each ḥadīth is present in a number of sequences. For a sequence size  $W=4$  a ḥadīth is present in at most 4 (darker shade) and at least 1 (lighter shade) sequence.

## Data cleaning

Isnads are first curated using a simple method, to mainly remove mursal isnads. First, for each transmitter a list of “generation” numbers are constructed. Generation of al-Kulayni himself is set to zeros, and for each isnād, generation number of each transmitter is set to the generation number of his pupil plus one. Then, for each transmitter  $u$ , a single generation number,  $gen(u)$  is estimated as the majority vote among their list of generation numbers. Then, only the edges  $(u,v)$  for which  $abs(gen(u)-gen(v)) \leq 2$  are retained for further processing.

## Results and Discussion

### Bigger Pictures

#### Research Question 1

To begin answering RQ1 we considered each sequence in al-Kāfī and calculated the percentage of ḥadīths where ghālī transmitters were influential in its transmission. We experimented with sequences of size 20 and 40. Figure 2 shows the percentages corresponding to sequences sliding over the al-Kāfī. Sequences of size 20 and 40 are depicted in blue and red, respectively.

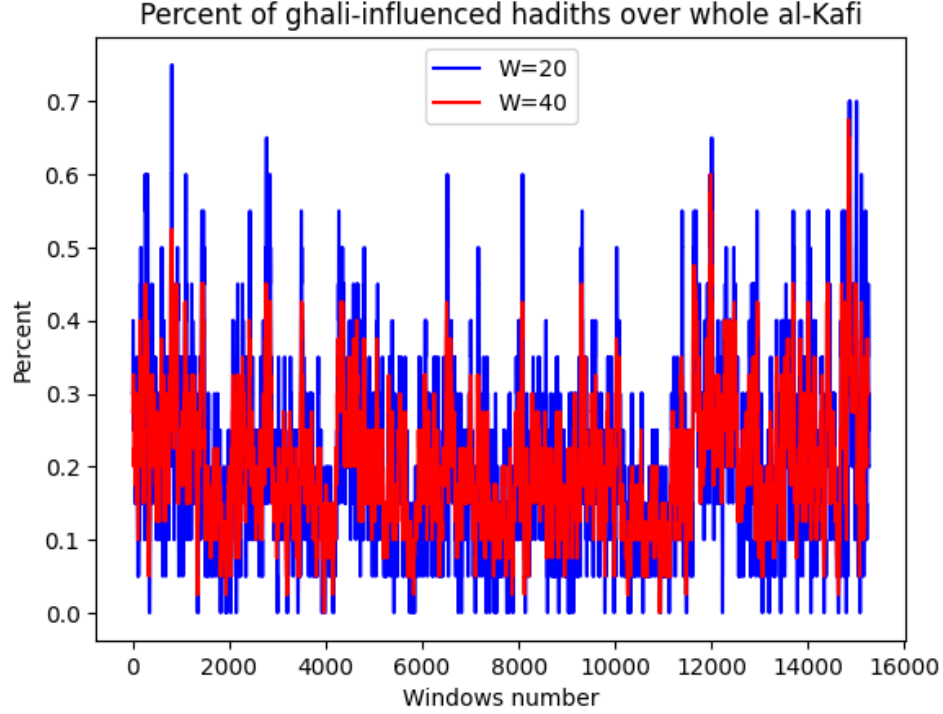


Figure 2. Average presence of *ghālī* transmitters across *al-Kāfi* for sequences of size 20 (blue) and 40 (red).

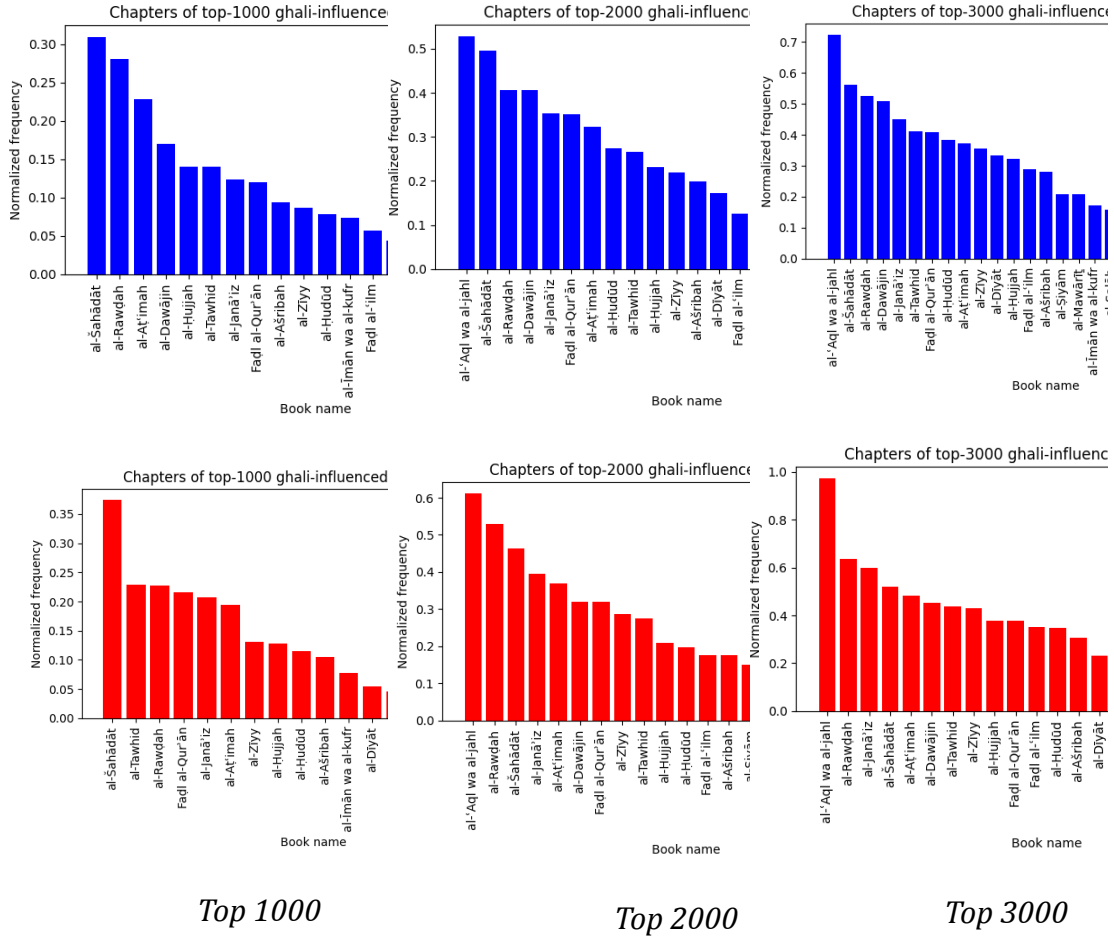
As each *ḥadīth* is present in a number of sequences, and each sequence corresponds to a percentage, each *ḥadīth* corresponds to a set of percentages. These percentages enable us to compare the influence of *ghālī* transmitters quantitatively. We use statistical tests of significance to ensure any observed difference is substantial or due to mere chance. Statistical tests of significance answer this question by measuring the probability (*p-value*) of observing the difference under the assumption that there is no meaningful difference (*null hypothesis*). If the probability is too small, that is below a threshold, traditionally taken as 0.05 or 0.01, the null hypothesis is rejected. In our case, we compare the *ḥadīth*-specific distributions with the distribution corresponding to all sequences in *al-Kāfi*. For each *ḥadīth*-specific set of sequences  $HS(h)$ , the null hypothesis is that the distribution  $C(h)$  is the same as the whole distribution. We used Mann–Whitney U test to test the significance with the threshold of 0.05.

Effect size measures the strength of the difference. We used Cliff's Delta to assess the effect size, and deemed a  $HS(h)$  as a *ghālī* sequence where *p-value* is less than 0.05 and Cliff's delta is larger than 0.474 (An effect size larger than 0.474 is traditionally taken as a strong effect). For more information the reader is referred to standard textbooks on hypothesis testing, such as *Testing Statistical Hypotheses*.

Out of the sequences in Figure 4 we took *ḥadīths*  $h$  that their corresponding  $HS(h)$  (statistically) significantly differ from the average of *al-Kāfi* and have a strong effect size. Then, we sorted them by the effect size, and picked the top 1000, 2000, and 3000, *ḥadīths* respectively. We then looked at the chapters that these *ḥadīths* come from, and sorted these



chapters by frequency normalised by the number of *ḥadīths* in each chapter. The three pictures in Figure 5, give us a consistent view: in Figure 5.(a) and (b) the top 10 chapters are identical (with slightly different orders) and they share 9 chapters with the top 10 chapters of (c).



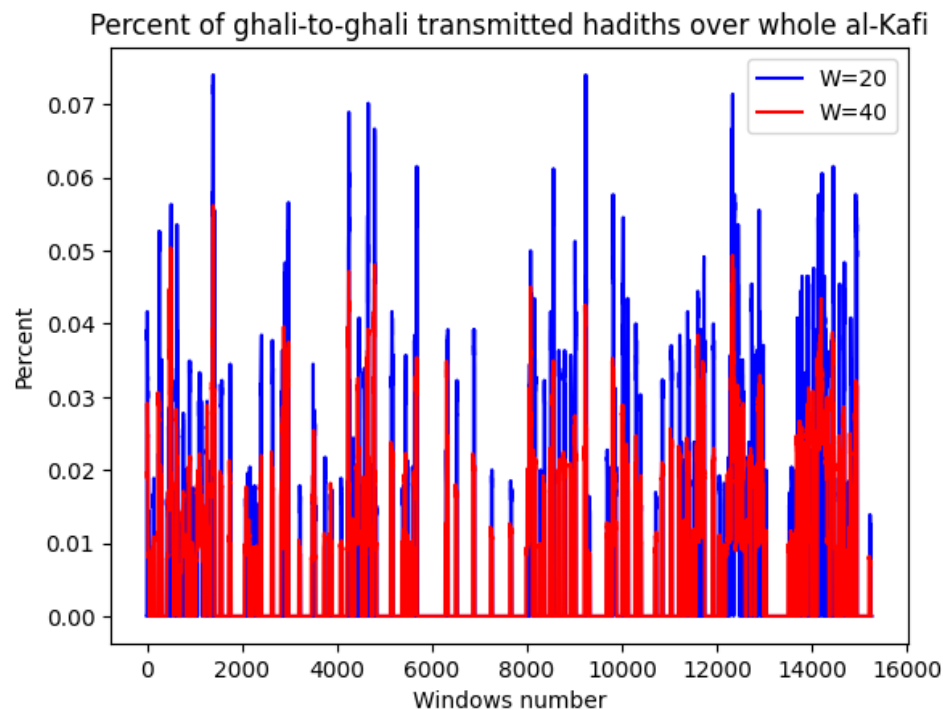
*RQ1 Results: Chapters of al-Kāfī with more pronounced ghālī influence compared to the average of al-Kāfī. Chapters of top 1000 (left), top 2000 (middle), and top 3000 (right) ḥadīths with sequence size 20 (top) and 40 (bottom).*

## Research Question 2

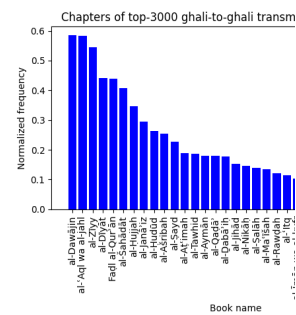
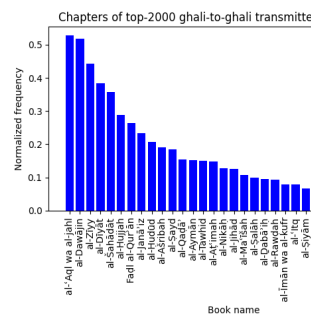
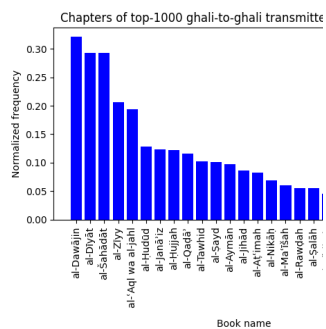
We studied three sub-research questions to examine the community transmission of *ghālī ḥadīths* in al-Kāfī.

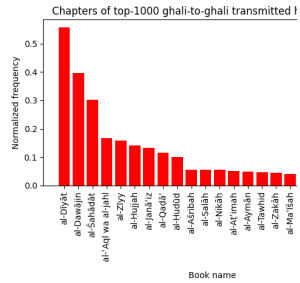
RQ21. RQ21 looks at spots in al-Kāfī where *ghālī* to/from *ghālī* transmission is clearly observable. Based on the same idea of RQ1, we calculated a new percentage for each sequence: the percentage of *ghālī*-to-*ghālī* links in the isnāds in the sequence. Then we

extracted *ḥadīths* whose corresponding list of percentages significantly and strongly differs from the average of al-Kafi and examined their encompassing chapters.

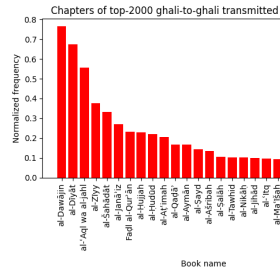


Average presence of *ghālī-ghālī* links across *al-Kāfī* i for sequences of size 20 (blue) and 49 (red).

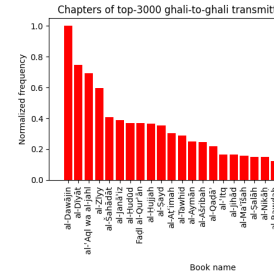




Top 1000



Top 2000



Top 3000

*RQ2 Results: Chapters of al-Kāfī with more pronounced presence of ghālī to ghālī transmission compared to the average of al-al-Kāfī . Chapters of top 1000 (left), top 2000 (middle), and top 3000 (right) with **sequence size 20 (top) and 40 (bottom)**.*

RQ22. To further explore community transmission, we examined the influence of accusation status of transmitters on them being directly connected (in the sense of transmitting one from the other). If we denote a link in an isnad chain with the tuple  $(u,v)$ , where  $u$  and  $v$  are transmitters, we examined the probability of  $u$  being accused given  $v$  is also accused, and compared that probability with that of  $u$  not being accused given  $v$  is accused. In other words, we examined statistical dependence between accusation statuses of  $u$  and  $v$ . We used the Chi-squared method to test al-Kāfī i data against the null hypothesis that  $v$ -accusation status is independent from that of  $u$ . The p-value is  $9.8e-5$  and the effect size index,  $w$ , is  $0.034$  which is considered a small effect.

RQ23. Finally, we compared the distribution of accusation status of  $u$  given  $v$  is ghali in the chapters from top 1000 *ḥadīths* from RQ1 with that from the whole al-Kāfī . In other words, we examined if the being in those chapters has an influence on the results of RQ22. Again, we used the Chi-squared test, resulting in a p-value of  $0.952$ . In this case the null-hypothesis cannot be rejected, leaving open the possibility that being in those chapters could influence the results of RQ22.

### Zooming In: 3 “Exaggerating” Chapters

Deeper understanding of the content and isnad;

Kitāb ad-Dawājīn:

Kitāb Faḍl al-Qurān;

Kitāb al-Ḥujjah

Choice motivated by: Rank in the presence of extremist isnad Diversity of content and isnad (considered a few more and compared, to find a diverse set) Research question: Are there key distinct extremist figures/communities present in different chapters / sections?

### Kitāb ad-Dawājīn

One of the highest extremist ranks: Topmost in three ranks In top-five for all others

Subject matter: domesticated animals, their well-beings

Pivotal extremist figures: Sahl bin Ziād al-Ādamī ar-Rāzī: 17 hadiths, 16 al-Ḥusain bin Yazīd an-Nawfalī: 5 hadiths, 6 Muḥammad bin Sinān az-Zāhirī: 1 hadith

Sahl bin Ziād al-Ādamī ar-Rāzī:

“Aḥmad b. Muḥammad b. ‘Isā declared him an extremist and a liar and sent him on exile to ar-Ray and so he resided there. ...” an-Najjāshī (d. 450 AH), Fihrist Asmā Musannifi ash-Shi’a

Many of the *ḥadīths* in this chapter are from his well-known book an-Nawādir

al-Kulainī was among the transmitters of his book in the community

Bāb Nawādir fī ad-Dawab (the section on animals miscellanea) On the well-being of domesticated animals (e.g., not beating them, particularly on their faces)

Bāb al-Ḥamām (the section on dove) On the domestication of doves

### Kitāb al-Ḥujjah

6th-9th in the extremist ranks

Considered key in Mudarressi’s definition of extremism

On the position of Imams

Pivotal extremist figures: Sahl bin Ziād al-Ādamī ar-Rāzī: 59 hadith, 8 Muḥammad bin Isā bin Ubaid al-Yaqtinī: 37 hadiths, 5 Muḥammad bin az-Zahirī: 4 hadith, <1 Muḥammad b. Alī Abū Sumayna: 3 hadith Muḥammad b. Sulaymān al-Dīlamī: 3 hadith

Bāb Thabāt al-Imāmah fī al-A’qāb (60 No heirs to imamah among brothers (or other relatives) Small section, only 5 *ḥadīths*, noise in statistics

Bāb anna al-Arḍ Lā-Takhlu min Ḥujjatillāh (46 The earth will not sustain without Imām Probably a major part copied from Imāmah by Muḥammad b. Isā.

### Threats to Validity

Threat: Influence of specific bio-bibliography authors

### Mitigations

a) Extending the data-set to other sources of bio-bibliography, particularly Ibn al-Ghazā'irī and Sunni sources To remedy this, we compiled the list of *ghālī* transmitters and those accused of ghuluww by Ibn al-Ghazā'irī and carried out the experiments once more by including this new data into our datasets. The results show that for all research questions, the inclusion of Ibn al-Ghazā'irī's data does not change the outcomes significantly.

b) Using machine learning to identify cohesive communities: this is

Threat: Reliance on the ordering and classification of subjects in al-Kāfī

Mitigation:

Using text similarity tools to extract keywords and *sequences* of variable size: Finding sub-manifolds of texts that are correlated with extremism

Threat: Small sample sizes in short sections / books

Mitigation: Gathering similar content from other collections of *ḥadīths*

Threat: Sensitivity to the selection of *ḥadīths* in al-Kāfī Mitigation: Extending to other collections of *ḥadīths* (possibly even non-Imāmī and non-Shī'ī)

## References

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Todo list:

- changing the format: Kaveh (Done)

- order of authors: two weeks to submission, everyone keeps a log

- literature survey: Modarressi, Sean Anthony, Mushegh Asatryan (Miraj Syed, Sarah Sevant, Maroussia, John Nawass), Gerami, Abtahi: Mostafa, Mohammad

- review of bio-bibliography: Fihrist Najjashi (Mohammad, done), Kashi (Mohammad), Tusi

- Prepare an appendix with a ranked list of transmitters with the designation in each book (Mohammad and Mostafa)

- Methodology:

- RQ1: review the methodology and the possible dependency on / sensitivity to window size and address it; if the research question is not consistent with experiment design, we need to discuss the experiment design again (Kaveh)

- RQ2: design a new experiment and document it (Kaveh)

- Revisiting the theory of ghuluww
- Github repo, Zenodo (DOI)