Ideational Diffusion and the Great Witch Hunt in Central Europe

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Abstract

The great upsurge of witch trials in early modern Europe remains a historical puzzle. Popularly known as the "witch craze", this eruption of persecution is puzzling because belief in witchcraft had existed for centuries, but large-scale witch-hunting appeared rather abruptly, spread widely, and was remarkably brutal in comparison with the past. We define a theory of ideational diffusion to describe the general process of the emergence and spread of a new idea along with its prescribed behavioral change, in this case the adoption of witch-hunting. Ideational diffusion distinguishes between the adoption of new ideas, which lead social actors reinterpret the world and thus to change their behavior, and the adoption of behavior alone. We relate how a new theory of witchcraft appeared in the fifteenth century and theorize that its widespread propagation, owing to the new technology of printing, matches our description of ideational diffusion. We then analyze the diffusion of witch trials in Central Europe by combining data on the publication of demonological treatises alongside climate, state capacity, religious economy, and city network variables. We find that cities adopted persecution after demonological treatises were printed, and that nearby trials induced neighbors to adopt persecution. Tracing the print vectors and social interdependence spurring witch-hunting helps us understand the general mechanisms behind spread of persecution.

Introduction

The great upsurge in the persecution of witches in early modern Europe remains a historical puzzle. In the period between 1450 and 1750 CE, about 90,000 people were prosecuted for witchcraft across Europe, resulting in about 45,000 executions (Levack 2006:23). Popularly known as the "witch craze", this eruption of persecution is puzzling because belief in witchcraft

had existed for centuries, but large-scale witch-hunting appeared rather abruptly, spread widely, and was remarkably brutal in comparison with the past.

Our general argument is that the great witch hunt was an episode of *ideational diffusion*, the outward movement of a reinterpretation of the social world from an initial source to others, or from a point of inception to a place of adoption. In line with general sociological diffusion models, agents' receptivity to the ideological innovation and their exposure to others who have made a prior adoption drive ideational diffusion (Everton and Pfaff 2022; Hsiao and Pfaff 2022; Valente and Vega Yon 2020). It is a dynamic process because adoption changes the context of action, and interdependent because others' decisions to adopt influence an actor's choice (Granovetter 1978; Macy 1990; Marwell and Oliver 1993). Diffusion occurs not only because ideas are convincing, techniques are useful, or innovations are advantageous (Young 2009), but because relevant others have already done so (Rogers 1962; Strang and Tuma 1993). In this case, new demonological theories provided a reinterpretation of the social world. Europeans' reinterpretation was not uniform, and neither was the incidence of witch trials uniform. An elaborated theory of witchcraft diffused via printing as literate burghers were gradually exposed to it. Simultaneously, as local elites organized witch hunts of their own, they influenced adjoining localities. Differential exposure to the elaborated theory and spatial reinforcement thus explains the extent and timing of the unfolding witch hunt.

Research on the "witch craze" is too extensive to review in depth, but several key themes are conspicuous in the literature. Historians propose a number of explanations that include the scapegoating of vulnerable women in hard times; religious strife arising out of the Reformation and Counter-Reformation; and shaky judicial institutions in newly centralizing states that failed to contain the popular demand for persecution (Anderson and Gordon 1978; Barstow 1994; Cohn

1975; Klaits 1985; Larner 1981; Levack 1995, 2015; Macfarlane 1967; Roper 2004; Trevor Roper 1967). Sociologists note that, although these general factors were undoubtedly in play in the early modern era, they were common to many parts of Europe, whereas the persecution of witches and sorcerers varied dramatically across countries, within them, and across time (Ben-Yehuda 1981; Jensen 2007; Mitschele 2014; Waite 2003).

Since Erikson (2005 [1966]), many scholars have argued that insecure rulers asserted control and assuaged popular grievances in hard times by persecuting women and community outsiders under the rubric of witchcraft (Barstow 1994; Jensen 2007; Roper 2004). Specifically, the scapegoating theory posits that places facing seasons of adverse climate resorted to witchcraft trials as a means to restore social order (Erikson 2005 [1966]; Jensen 2007; Oster 2004). Stark (2003) and Levack (2015) argue that weak rulers were unable to persecute. Going further, Johnson and Koyama (2019:204) argue that legal fragmentation fostered the persecution of witches and strong governmental authority suppressed persecution.

Recent work points to the importance of the supply side because witch hunts were not spontaneous affairs driven by popular superstition, but rather judicial operations requiring the involvement of local ecclesiastical and state authorities (Johnson and Koyama 2019). Mixon (2015) and Kulkarni and Pfaff (2022) argue that witch-hunting was an expression of sectarianism, as religious hard-liners tried to increase demand for their leadership through persecution of deviants. Leeson and Russ (2017) contend that persecution expressed non-price competition between Catholics and Protestants for religious market share in those areas of Europe in which confessional conflict was most intense.

Rather than pointing to a single master variable, the historical consensus suggests that the great witch hunt occurred because of a conjuncture of factors, including climatic pressures,

political strife, weak executive control over judicial officials, and confessional rivalries (for reviews of the extensive literature, see Golden 2006; Goodare 2016; Levack 2013, 2015). Our approach builds on the conjunctural explanation while attempting to model the complimentary role of ideas explicitly. We emphasize the role of symbolic reinterpretation and interdependence between actors in the adoption of witch-hunting. Persecution seems to have "spread contagiously" without a coordinated effort by central rulers to promote it (Behringer 1996:84; Jensen 2007:121). If not by imperial or ecclesiastical fiat, how did witch-hunting go from unusual and isolated occurrence to an extensive and long-lasting phenomenon? How did a new understanding of witchcraft get a footing, and how did its gradual spread reinforce subsequent persecution?

The advent of printing suggests an answer. Indeed, the coincidence between the spread of witch persecution and the advent of printing is striking: printed books appeared around the year 1450, the first handbook for witch hunters appeared in 1487, and it spawned, in turn, a new genre of witch-hunting manuals (see Figure 1). Print allowed for the dissemination of a new ideology redefining witchcraft as harmful magic (*maleficium*) practiced by people in league with the devil. Printing did not create this new understanding (Machielsen 2020). The first articulation of the "science" of demonology preceded printing, but it was limited at first to narrow circles of theologians and inquisitors. Print allowed the theory to escape the confines of the clerical elite, helping to trigger the repeated waves of persecution that define the great witch hunt. Our findings show that the judicial persecution of witches spread so widely because of a combination of ideational diffusion through printing and the social interdependence of cities in trade networks. Local elites learned new ideas about witchcraft from printed tomes and from the example provided by neighboring authorities who had begun trying witches.

Beginning with Erikson's (2005 [1966]) study of the Salem witch hunt, most of the sociological work on witchcraft persecution has been theoretical and discursive. A major exception is Jensen's (2007) tests of the prevailing breakdown and scapegoat theories of witch persecution with a variety of historical data sets, finding that pestilence, hardship, and war are generally, though not always precisely, associated with the timing and location of the large-scale witch-hunting. We take research a step further by developing and testing a diffusion model that incorporates learning and social networks.

To test our theory, we assembled a unique dataset of 553 cities in Central Europe observed between 1400 and 1679, for which we measured the timing and location of witchcraft trials and the locations where witch-hunting manuals were published. To capture social influence, we focus on temporal and spatial proximity as well as the position of towns in the late medieval trade network. We find that publication of the elaborated theory of witchcraft and learning from other adopters combined to spread witch trials across Central Europe. We then provide further historical evidence of how revised ideas transformed practices, validating our hypothesized mechanism. Beyond institutional characteristics, exposure to the new ideology through printing and interdependence among cities through trade relations influenced which cities used judicial persecution against witches.

The Elaborated Theory of Witchcraft Reinterpreted Magic as an Imminent Threat

In early modern Europe, a new theory of witchcraft (demonology) provided an ideological imperative for persecution and a practical rationale for conducting witch-hunts. Historians refer to this innovation as the "elaborated theory" of witchcraft (Cohn 1975; Goodare 2016; Levack 2006; Machielsen 2020; Mackay 2006a). Its proponents offered a new diabolical

worldview that redefined witchcraft as an urgent problem demanding radical solutions. They called for the legal prosecution of alleged witches by secular magistrates operating with relaxed judicial norms. They depicted witchcraft as *conspiratorial activity against godly society* and not simply mischief by village sorceresses, pagans, or ignorant peasants. Such a threat to government and religion seemed to necessitate determined legal action.

These ideas might have remained marginal or of interest only to small circles of theologians, moralists, and inquisitors but for the contemporaneous invention of the printing press which reduced the cost of producing books and spurred a burgeoning book trade (Dittmar and Seabold 2019; Eisenstein 1980, 2005; Rubin 2014). The elaborated theory of witchcraft superseded existing popular superstitions and cultural idioms (Sabean 1984), gradually synthesizing them with learned ideas expounded in books (Goodare 2016; Machielsen 2020). Witch-hunting manuals insisted that magistrates were responsible for persecution and gave them an arsenal of judicial techniques to further their work. Combined, the elaborated theory and the printed manual were new technologies that transformed the supply-side of persecution.

This was a profound change because, for most of medieval history, ecclesiastical and secular authorities were relatively tolerant of suspected witches, and the persecution of witches was sporadic. However, beginning in the fifteenth century, a new consensus was forming among scholars and theologians that all magicians, whether "white" or "black", were idolaters and heretics (Bailey 2003; Ben-Yehuda 1980; Goodare 2016; Levack 2006:36–38). From there, the "elaborated" concept went further by contending that witchcraft was a rampant public threat, because witches and wizards had made demonic pacts and organized themselves into satanic conspiracies (Behringer 1996; Cohn 1975; Gaskill 2010; Goodare 2016; Levack 2006:15–17). Rulers could no longer ignore witches or regard them as bush magicians, pagan holdovers, or

harmless eccentrics. Experts now defined them as conspirators bent on perverting the Church, government, and godly society (Machielsen 2020; Mackay 2006b:19–24).

The advent of printing was crucial to the spread of persecution because it allowed the elaborated theory to escape from the confines of theologians and inquisitors through the publication of dedicated witch-hunting manuals. Their authors urged *secular magistrates*—not only religious authorities or inquisitors, as in past practice—to investigate, try, and punish witches. The manuals endorsed irregular standards of interrogation (torture), evidence (hearsay, dreams, etc.), and procedure (indefinite detention) that were ordinarily forbidden in legal proceedings as necessary and justified in the prosecution of witches.

At first glance, it seems paradoxical that belief in the diabolical power of witches grew during a period in which urban literacy and humanist education were expanding (Grendler 1990; Schindling 1988). What made *literate* European society susceptible to the elaborated theory of witchcraft? The notion that witchcraft was a "special form of heresy" undermining godly society and furthering satanic plans to destroy the Christian world resonated in an early modern Europe riven by religious strife, war, and famine (Jensen 2007; Mackay 2006b; McDonnell, Bail, and Tavory 2017). Ben-Yehuda (1980:23) argues that the elaborated theory responded to the elite preoccupation with restoring the "religious moral boundaries of medieval society" shaken by economic and social change and the collapse of the traditional Catholic worldview. In the context of the "stress" and the "deep confusion and anomie" accompanying this breakdown of the Church's hegemony (13), moral entrepreneurs developed a new worldview centering on the witch as diabolical threat to social order. Protestants took up the theory because they had the same need to restore order and resolve religious confusion. The result was the "witch craze" as an ongoing moral crusade that crossed territorial and confessional boundaries (15).

In the context of early modern Europe, the elaborated theory was not a crackpot idea. There was no bright line separating empirical science from pseudo-sciences like alchemy, astrology, or demonology. Learned people commonly held the notion that the world's welfare was the result of a cosmic struggle between good and evil (Goodare 2016; Thomas 1971:105). In this worldview, people could harness supernatural forces that might tip the balance in the struggle between the godly and satanic camps. Common and educated people alike already believed in magic and the "diabolical efficacy of witchcraft" (McCarraher 2019:31). It was taken for granted that Satan was actively involved in the affairs of the world, making diabolical conspiracies led by witches plausible threats (Trevor Roper 1967).

Malleus maleficarum: Transmitter of ideational innovation

The elaborated theory synthesized old and new beliefs. The premiere expression of it was *Malleus maleficarum* ("The Hammer of Evil-Doers"). Authored in 1487 by Heinrich Kramer, a Dominican friar, theologian, and inquisitor, and, allegedly, by Jacob Sprenger, a professor in Cologne's prestigious faculty of theology (Sprenger probably played no part in its composition; see Behringer 2006:718), it was the first printed guide for witch-hunters. The book's great innovation was to combine an elaborate theological explanation of witchcraft with practical guidance on the methods of investigating, interrogating, and convicting witches. It endorsed the use of inquisitorial methods by secular judges and argued for a relaxation of legal restraints in witchcraft prosecution. Kramer was eager to boost the apparent legitimacy of the treatise, and the first edition as well as some subsequent editions contained endorsements, including approbation by the Cologne theological faculty, a papal bull calling for suppression of witchcraft, and a German imperial decree against witches.

Malleus maleficarum is the centerpiece of our testing of ideational diffusion. It was not the first book on witchcraft, but it was the first practical handbook that combined the theory and practice of persecution (Behringer 2006:721). At the time of its appearance, there was only a shaky consensus among learned authorities on the crucial questions of who witches were, what they did, and why they had supernatural powers (Goodare 2016; Levack 2013, 2015; Machielsen 2020). The willingness of Kramer to expound confidently on these questions is part of what made *Malleus* so influential. The book solidified the elaborated theory by bringing together "demonological theory with first-hand experience" of conducting inquisitions and trials, making the book intellectually engaging and eminently practical (Gaskill 2010:22–26). By the 1520s, the *Malleus* had established itself as the "standard work" on witchcraft in Central European libraries, from whence it influenced academics, preachers, literate burghers, and magistrates (Behringer 1997:73–76; Gaskill 2010:22–26). Other books on witchcraft were published, such as Johannes Nider's *Formicarius* (1475), but they lacked the practical focus on conducting investigations and trials, focusing instead on a diagnosis of moral problems and the need for religious instruction (Bailey 2003:124–25). Jerouschek and Behringer (2000:11) rightly call the *Malleus* "the central book in the history of European witch persecution."

As Figure 1 indicates, the persecution of witches did not begin with the appearance of the *Malleus*, but the rate at which cities took up the practice accelerated once witch-hunting manuals appeared. Absent the invention of movable-type printing, it is hard to imagine that the elaborated theory would have diffused as widely as it did. Kramer first published the *Malleus maleficarum* in Speyer in 1487, with another thirteen editions printed by 1520 and a further fifteen between

1574 and 1620.[1] As the foremost authority on the subject, subsequent witch-hunting manuals all included material from the *Malleus*, and the book directly influenced witchcraft legislation across Europe (Levack 2006:57). For example, when Emperor Charles V promulgated a new imperial law code in 1532 (the *Carolina)*, it now included witchcraft (*maleficia*) among the capital offences. From the beginning, Kramer vindictively promoted his book as reproach against ecclesiastical authorities who had obstructed his campaigns of persecution (Jerouschek 2006). In promoting the book, "Kramer's strategy was aimed at princes and their law courts" (Behringer 2006: 719). As the influence of the *Malleus* spread, its take-up by the HRE's diverse political and legal actors lent it increasing clout. As scholars of policy diffusion have observed across time and place, authorization by state actors is a key factor in "converting interpretative schemas into imperatives" (Haveman, Rao, and Paruchuri 2007:118).

[1] Most books of this era, including other witch-hunting manuals, only had a single edition; 28 editions is an outlier. One indication of how widely travelled the book was is that more than eight hundred copies (three times the next most popular witch-hunting manual) of the *Malleus* survive to the present day.

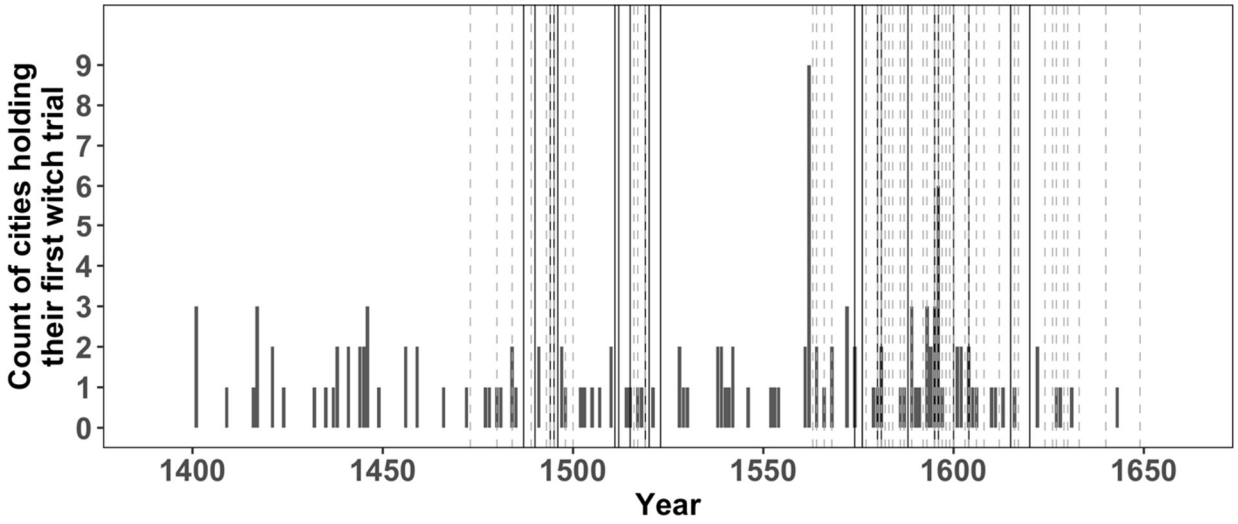

Figure 1. First witch trials across cities in the Holy Roman Empire and editions of demonological texts (*Malleus maleficarum* in solid black lines; other texts, described in the Appendix, in dashed grey)

A Model of Ideational Diffusion as an Explanation for the Great Witch Hunt

We base our model of ideational diffusion on the idea that complex innovations spread through multiple channels and that their adoption is influenced by social reinforcement. Diffusion models generally identify mechanisms such as learning, emulation, imitation, persuasion, coercion, and competition as mechanisms fostering adoption (Bail, Brown, and Wimmer 2019; Becker et al. 2020; Gilardi and Wasserfallen 2019; Wimmer 2021). Adoption of an innovation can be reactive, focused on payoffs in a changing social environment, or proactive, focused on improvement and profitable strategies (Elkins and Simmons 2005). Sociological diffusion models that concentrate on interdependence usually argue for mechanical effects of threshold relations (Granovetter 1978; Macy et al. 2019; Marwell and Oliver 1993; Strang and Macy 2001; Watts 2002) or network structure (Berry et al. 2019; Centola 2015; Flache and Macy

2011; Goldberg and Stein 2018). However, ideational diffusion entails social interdependence in two senses: (1) the re-interpretation of the social world through novel ideas and (2) the adoption of a new behavior consistent with the revised beliefs and the actions of socially proximate others (Charles 2020; Gandrud 2013; Pierotti 2013).

Some diffusion research can be unpersuasive because many theories essentially focus on single behaviors as neat chains of diffusion among actors in viral fashion. While the clinically spare diffusion model borrowed from epidemiology is useful, we know that it is not accurate for all diseases (Kistler, Huddleston, and Bedford 2022), and is limited where information is partial, biased or distorted (Hunzaker 2016), and contested by rival ideas and behaviors (Hébert-Dufresne, Scarpino, and Young 2020; Hsiao 2022). Ideational diffusion is more than simply the viral adoption of innovation. It entails the spread of radically new understandings of the world and the action that flows from them. It relies on multiple diffusion processes across multiple domains, such as printing and trade routes (Hsiao and Pfaff 2022; Wimmer, Lee, and LaViolette 2024).

One of the problems in applying models of diffusion to real-life historical situations is that process of adoption might not correspond to the simplifying assumptions of the models. Models that rely on contagion or unidirectional social influence presume a relatively straightforward and expeditious adoption by agents after exposure to the innovation. However, we have long known that the adoption of innovations is usually not so straightforward in practice (Everton and Pfaff 2022). Diffusion models that rely on learning as a mechanism may be more gradual, as gaining information about the innovation as well as its expected costs and benefits may require time and effort (Young 2009). Our model argues for the importance of complementarity and social reinforcement as necessary, network-structural features of adoption

in addition to exposure to novelty when innovation is costly, dangerous, or of uncertain benefit. However, it differs from the complex contagion model (Centola 2018; Centola and Macy 2007) in that adoption is fostered by ideological reinterpretation and not only by multiple reinforcement across wide bridges.

Figure 2 visualizes our theoretical model of ideational diffusion across three periods from the inception of an innovation through its "percolation" through social networks to its widespread adoption. We argue that the diffusion of innovations does not always occur in wildfire fashion through viral transmission. A more gradual process is evident in many instances of ideational diffusion that require the reinterpretation of existing understandings resulting in widespread cultural change. Applied to witch-hunting, processes of percolation would occur as urban elites begin to be exposed to the elaborated theory of witchcraft. Depending on their susceptibility and interest, some cities adopt the practice while others do not. Subsequently, the initial cities which decided to adopt the innovation become new sources of information about it that can influence nearby cities in their neighborhood. These islands of innovation percolate outward to their network neighbors. Those neighbors, in turn, are now exposed to information about the innovation. This process is ongoing to the point of saturation as new cities across the network are gradually exposed to the innovation and make adoption decisions of their own (Solomon et al. 2000).

As in conventional sociological diffusion models, in our model one's own behavior and the behavior of neighbors (whether in physical or social space) influences whether one adopts new behavior as the new behavior percolates and perhaps becomes widespread. One's re-interpretation of the social world through new ideas paves the way for adopting the new behavior prescribed by the new worldview. Plus, your neighbors' re-interpretation affects your subsequent

worldview and behavior. Our model is thus an elaboration of the general sociological diffusion framework, as the uptake of witch-hunting is an instance in which exposure to the elaborated theory is not enough to trigger widespread adoption of the witch-hunt. In most instances, the persecution of witches was costly, potentially dangerous, and with uncertain benefits.[2] In such instances, actors will be reluctant to adopt. Our framework posits that when agents learn about an innovation, are attracted to it, and believe in its merits, they may nevertheless hesitate to adopt while they await confirmation that other similar agents have adopted. A neighbor's adoption then presents them with another opportunity to adopt.

As Ingram and Rao (2004:482) argue, for actors considering institutional innovations efficiency and effectiveness are not the only considerations but rather "whether they are socially and politically acceptable." In the case of the witch-hunt, several mechanisms may have been at work besides publishing, as travel, trade and the nearby installation of new judicial officials spread the elaborated theory. At the local level, magistrates and ecclesiastical officials would have thought about new idea of witchcraft in light of witch-hunting manuals and by observing the actions of authorities in other cities.

Exposure to ideological innovation and observation of others' behavior are thus mutually reinforcing. As the first local authorities put the new theory into action, inception triggered the subsequent percolation of the innovation among nearby towns, as witch-hunting was now instantiated in concrete actions that could be observed and emulated. We posit that the more exposed a city was to twin influences of the elaborated theory and social reinforcement by

[2] Witch-hunting was associated with popular unrest, economic disruption, and rebellion (Jensen 2007). In fact, we know that strong and secure rulers generally tried to suppress witch-hunting (Johnson and Koyama 2019; Kulkarni and Pfaff 2022; Stark 2003).

neighbors' having initiated persecution, the more its local authorities would be liable to reinterpret reported deviance as witchcraft. Having done so, they would react to perceived threats to local order and credible accusations of witchcraft by launching witchcraft investigations and holding trials.

Ideational diffusion explains why the *Malleus* played such an important role in triggering widespread adoption of witch-hunting. It provided both the intellectual justification for persecution and a package of judicial practices to enable witch-hunts. It was theoretically innovative, uniting popular superstitions with a literate conceptualization of a real and growing threat to godly society. It was legitimate, endorsed by influential actors including theological faculties, by a papal bull, and by an imperial decree on the suppression of witchcraft. It was practical, providing a template for action. Once neighbors appeared convinced because they took up witch-hunting, the odds that an urban elite would do so increased as well, and the process of diffusion accelerated. In other words, ideational diffusion generates the basis for subsequent corresponding behavior – such as witchcraft trials.

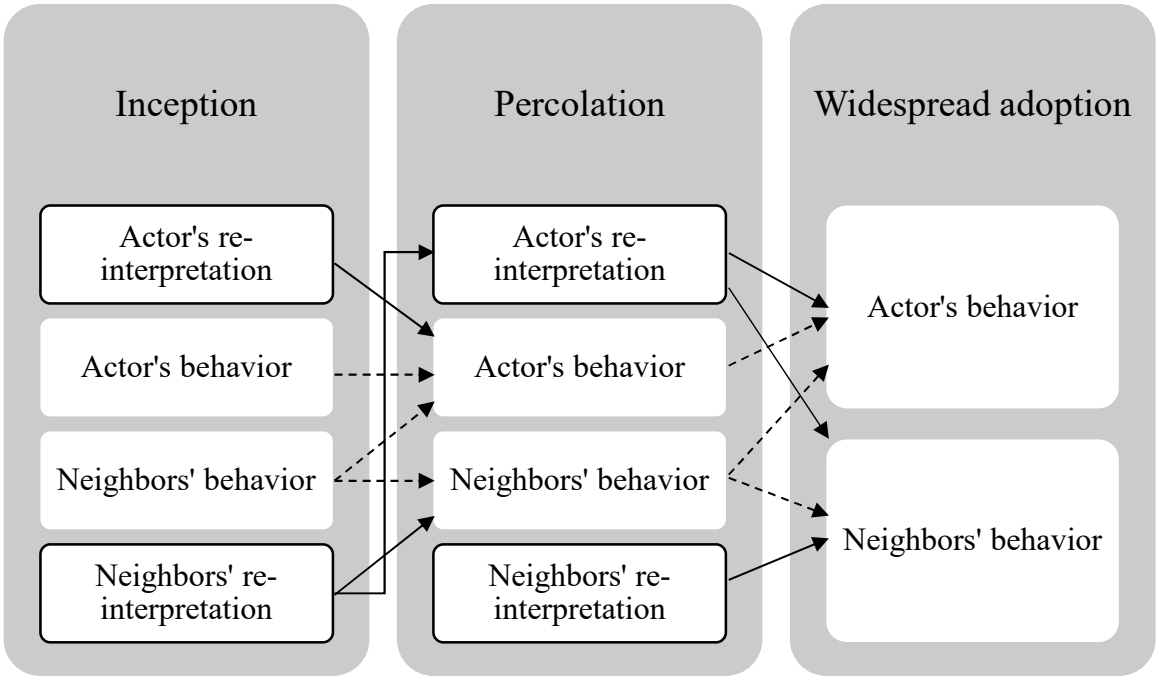

Figure 2. A theoretical model of ideational diffusion across three periods

Note. The conventional behavioral diffusion model is represented by the boxes without outlines and dashed arrows. Our addition of re-interpretation, or reformation of ideas, is represented by the boxes with outlines and solid arrows.

Hypotheses

We argue that the social logic of witch trials spread because elite actors were exposed to the "elaborated" theory of witchcraft through printing and by neighbors, both of which offered a new understanding of the governance challenge confronting them and a new set of practices to address it. Percolation and social interdependence fostered re-interpretation. Actors have to learn about a new social logic but will be more likely to adopt it with social reinforcement, such as if its utility and legitimacy is enhanced by like others adopting it (Rogers 1962; Strang and Soule

1998; Young 2009). Adoption of a behavior as complex as judicial witch-hunting is most likely the result of multiple social pressures (Restrepo and Wolff 2022).

We expect that witch trials increased following the spread of the elaborated concept of witchcraft and new inquisitorial procedures via new print media. We imagine three main channels of ideational diffusion:

First, *we expect that places closer in time and space to the publication of the Malleus were more likely to have trials* (Hypothesis 1). Although we do not know who purchased the *Malleus* and the extent of its dispersal, it is reasonable to expect that exposure was greatest near publication cities.

Second, *we posit that places closer in time and space to other trials will themselves have trials* (Hypothesis 2). Elites from a prosecuting town will have been engaged in material and social exchange with their neighbors, relaying new demonological ideas. In both of these instances, social proximity makes it more likely that local elites encounter the new idea, as well as provides information about the soundness or viability of new logics and actions.

Third, *we expect that more socially connected cities were more likely to have trials* (Hypothesis 3).[3] An avenue for the circulation of *Malleus*-style witch-hunting was along the normal paths of communication and material exchange through trade. The social structure of trade ties between cities would have funneled new ideas into well-connected cities more swiftly but left isolated cities delayed and less exposed.

[3] In many cases it is advisable to consider exposure to innovation as the count or proportion of ties to adopters alongside broader connectedness. We assess this through proximity to other adopters (H2) because cities are immobile and cannot move to congregate with adopters.

The observables in our empirical test of the model are behavioral (own adoption or neighbor's adoption of witch-hunting). Effectively, we associate the timing and location of *Malleus* editions (H1) and social connections (H3) with greater probability of re-interpreting witchcraft in line with the ideas in the text. The adoption of trials by other cities provides information about others' re-interpretation of witchcraft (H2). While we will measure and assess these separately, ideational change and behavioral observation complement each other. A neighbor's behavioral change implies their re-interpretation. To observe witch trials elsewhere provides both ideational and behavioral pressure on an actor. And interaction and exchange with that fellow city that takes up witch trials will communicate both ideas and behavior.

Our analysis is meant to test our model but not to refute existing explanations for the great witch hunt in favor of our own. We do not propose a winner-take-all test. The historiographical consensus is that the conjuncture of several factors (religious strife, threats to subsistence, governing capacity) combined to cause large-scale persecution (see, e.g., Golden 2006; Goodare 2016; Levack 2013, 2015). In addition to the likelihood that several contributing factors reinforced each other, it is possible that prior studies detected spatial relationships that were in fact based on the underlying but unmeasured diffusion patterns (Betz, Cook, and Hollenbach 2021; Drolc, Gandrud, and Williams 2021).

Of course, to estimate properly the association between ideational diffusion and the witch-hunt, we have to consider associations with other variables. First, we include the religious competition hypothesis that nearby confessional battles prompted witch trials. Second, we revisit the scapegoating theory that argues Europeans prosecuted witches when moral outsiders could be blamed for episodic calamities like plagues, famines, and crop failures (Ben-Yehuda 1980, 1981;

Jensen 2007). Finally, the character of local governance probably influenced the incidence of witchcraft persecution (Johnson and Koyama 2019; Levack 2015; Stark 2003).

Data and Methods

Our sample of cities comes from Becker et al. (2023). This dataset includes larger towns and cities (those with a population estimated at 2,000+) in the *de jure* Holy Roman Empire (hereafter HRE) and its environs. We focus our study on the HRE for several reasons. First, Central Europe was one of the most important arenas of persecution, its urban network consisting of many small and medium-sized cities. Second, because it was not a centralized monarchy, cities had diverse rights of self-government, and imperial policy did not determine local decisions to hunt witches, resulting in substantial variability in persecution. Third, the HRE reveals "wide discrepancies in the geography of witch-hunting" and substantial confessional variation in the wake of the Reformation (Golden 2006:xxvii; Levack 2013). Finally, we build on reliable existing data sets for the HRE that include measures of important social, economic and network variables, limiting the risk of omitted variable bias. We want to trace the temporal and spatial influence of several potential factors and therefore model witch trials as a function of temporal and spatial lags plus city-specific factors. In this, we follow the precedent of sociological studies of diffusion (Braun 2011; Doten-Snitker 2024a; Hedström 1994; Soule 2012) that situate units of analysis within social fields, capturing social influence, as well as incorporating local susceptibility or propensity to engage in the behavior in focus. Below we outline our measurement and modeling choices; additional details are in the appendix.

Although the data are well-suited to testing our model, they have limitations as well. Because our data set focuses on cities, it misses persecution taking place in rural areas and small

towns (Golden 2006). As measurable information on cities is more complete than that for rural areas, the tradeoff is probably necessary. Quantitative data observed at the city level cannot demonstrate how individuals reacted to new demonological ideas and how subjective changes influenced political behavior. For this reason, after presenting the quantitative results, we illustrate the reinterpretation-to-behavior pathway with qualitative historical evidence.

Witch trials

Witch trials are our outcome variable. Some witch trials were small affairs targeting one or two accused persons, while others involved dozens of accused. There are two potential ways to measure trials: whether a trial occurred at all and the number of people tried. We obtain both binary and count measures from the trial data compiled by Leeson and Russ (2017). The synthesis of these sources covers most of Central Europe. When a trial was recorded in a city in the Becker et al. data, it is included in our analysis. A city has a value of 0 for years in which no trials were reported. Because our theory focuses on the first adoption of an ideological innovation, we binarize whether a trial was held in a city in a year and then censor our city observations after the first trial. Figure 3 maps the geographic patterns of the sample, which suggests that there was a spatial correlation between printing and trials. About one quarter of the 553 cities in this sample held one or more witch trials. Table 1 presents descriptive statistics for these measures.

Elaborated theory of witchcraft

Our core interest is the potential covariation between witch trials and new conceptions of witchcraft as diabolical conspiracy, particularly the use of handbooks for detecting and prosecuting it. We measure the ideological innovation through the printing of *Malleus maleficarum*. We searched the Universal Short Title Catalogue (USTC) (Becker and Pascali

2019; Dittmar and Seabold 2019) and recorded the year and city of printing for each edition. In total, printers published 28 editions in nine cities during 1450-1650, the scope of the USTC. For any given printing city and year, the *Malleus* ranged from 0.2% to 9.1% of editions of books published. On the decade scale and restricted to the specific publisher, the *Malleus* ranged from 0.2% to 14.2% of a printer's portfolio. For each printing city in 1450-1650, the *Malleus* represented 0.003% to 0.39% of the total number of published titles listed in the USTC. From these figures we calculated a temporal lag $Ideas_i$ for each city i the sum of Malleus editions N in the cities j printed in the 10 years prior to year t, the formula developed by Hedström (1994; Andrews and Biggs 2006; Braun 2011; Doten-Snitker 2024a):

$$Ideas_i = \sum_{t-10}^{t-1} N_j$$

This formulation is constant across the sample within a given year, but given the regional nature of the book trade, people in cities closer to where an edition was published were more likely to read the book and to adopt its recommendations, reinterpreting their social world. Because we know the locations of each edition, we can scale the temporal lag by distance, again following Hedström (1994) and Braun (2011). Using the Euclidean distances between the sample cities and the publishing cities, we calculated the sum of the number of *Malleus maleficarum* editions N in city j scaled by the square root of the distances between i and j:

$$NearIdeas_i = \sum_{t-10}^{t-1} \frac{N_j}{\sqrt{D_{ij}}}$$

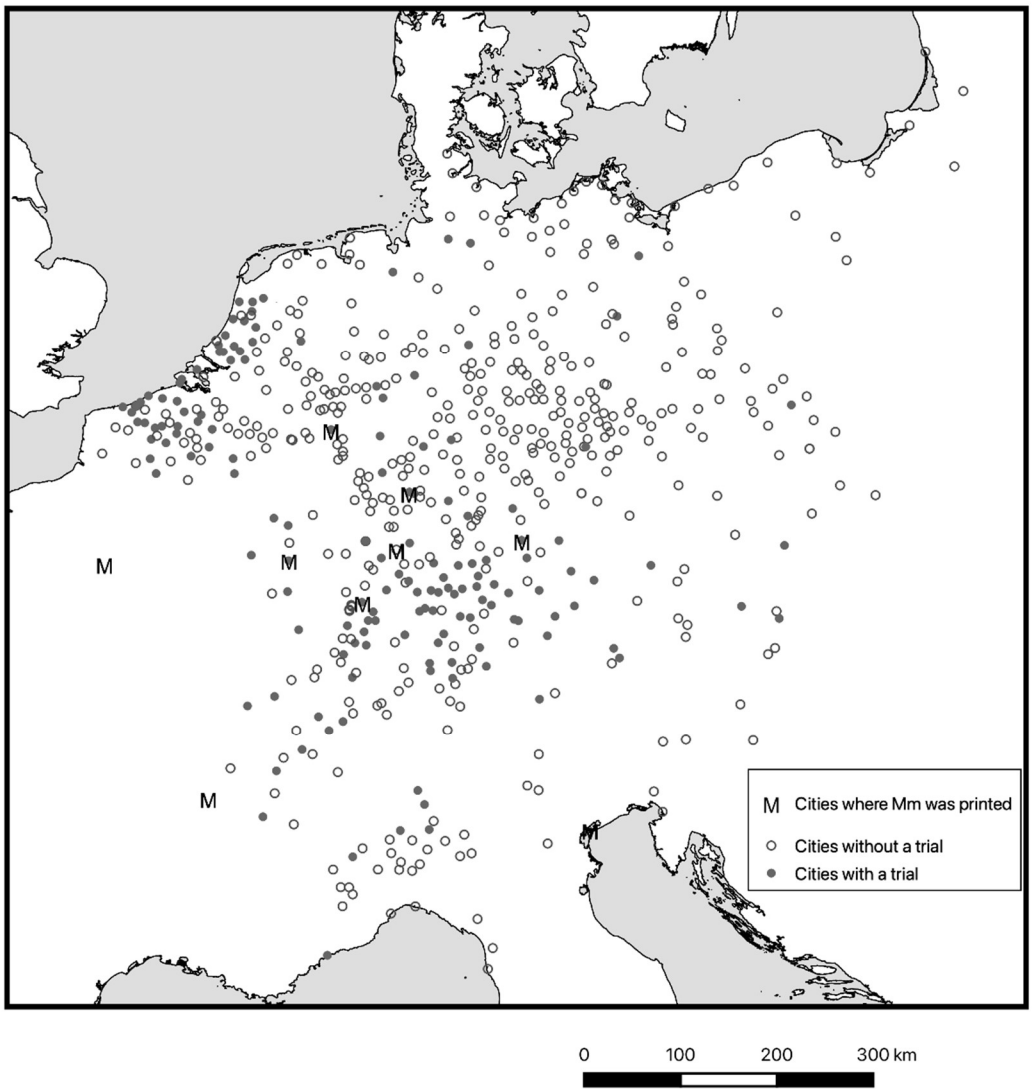

Figure 3. Witch trials in Central Europe, 1400-1679

Besides learning about how to prosecute accused witches directly from new books, cities spurred others' witch-hunting behavior. We calculated the number of persons tried in the previous 10 years and then scaled those by Euclidean distance, using the same formulas we did with the measures for publishing *Malleus maleficarum*. In this case, the first measure, the count of people tried previously, amounts to a year-specific observation of witch trials within this

sample. The second measure accounts for individual cities' proximity to witch trials, capturing a possible neighborhood effect. The two operationalize the influence of others' reinterpretation of the social world.

Some cities may have been exposed to new demonological ideas and legal practices by virtue of their structural position within the HRE's exchange network. We use the cities' centrality in the trade network reconstructed by Becker et al. (2023). They reconstructed the social network between cities in the HRE as revealed by their location on the contemporaneous regional and long-distance European trade routes (*Fernhandelstrassen*). They coded cities as having a direct tie to another city if they occupied adjoining positions on overland trade routes or if they could be reached through river traffic or sea routes.

Places more central in trading networks would have been more accustomed to learning new ideas that flowed with the people and goods passing through their gates. Our model includes three standard measures of network centrality (Wasserman and Faust 1994).[4] Degree centrality measures the number of other cities directly connected to a city along trade routes, without intermediary cities. Betweenness measures being an intermediary on the shortest paths between pairs of other cities. Eigenvector centrality takes account of the connectedness of the other cities connected to a city, with higher values representing connection to other cities that have a higher eigen scores. Eigenvector centrality may be especially important because ties to more central cities would be more politically important than ties to peripheral cities and might have placed cities under greater elite pressure to conform to ideological and governmental innovation.

[4] Network positions included cities' immediate ties beyond Becker et al.'s geographic scope, meaning that geographically peripheral cities were not artificially peripheral, with biased centrality scores.

Positive relationships between these measures and witch trials indicate ideational diffusion, with varying strength of evidence. A relationship between demonological printing and witch trials is direct evidence of ideational diffusion. In the absence of such a relationship, relationships between trials and persons tried recently and network centrality would indicate social interdependence in adopting new ideas about witches and new methods for dealing with them, but only as a necessary precursor to behavioral diffusion and outside of demonological literature.

Religious warfare

We use data from Leeson and Russ (2017) on religious conflict measured through inter-confessional warfare. Instead of grouping battles into spatial grid cells as they did, we calculated the number of battles in the 10 years prior, in exactly the same manner as we do for summing the number of *Malleus maleficarum* editions. We then again mimicked our spatiotemporal lag for printing new ideas, using the same equation to calculate distance-scaled exposure to confessional battles using the Euclidean distance between cities and battles. Larger values for each of these should be associated with more trials.

Scapegoating

Economic historians argue that witchcraft accusations are greater during times of economic insecurity brought on by variation in harvest yields (Kulkarni and Pfaff 2022; Miguel 2005; Oster 2004; but see Christian 2019). We approximate subsistence pressures via climate reprojections during the previous year's growing season, March through September. We use the Community Climate Systems Model 4.0 (CCSM4.0) monthly climate data (Landrum et al.

2012), which is preferable to other climate data[5] because it has broader and finer geographic coverage. CCSM4.0 provides estimates at 1˚ frequency for the entire globe.

Prior work has used mean temperature (Celsius) across these months, without local normalizations. However, this measure estimates only being located in a colder or warmer climate and not a local climactic impact on harvests and subsistence. Instead, we compare each lagged mean March-September reprojected monthly mean temperature to the 60 years prior, representing about the memory of two generations (DeWitte 2014; Jonker 2003; Stelter, de la Croix, and Myrskylä 2021; Strawhacker et al. 2020), similar to the standardized precipitation index used by climatologists (Guttman 1999; Svoboda, Hayes, and Wood 2012; Werum and Ratcliff 2022; Wu et al. 2005). While year-to-year fluctuation is normal, the human scale of unusual climate is in reference to remembered past seasons. We subtract the 60-year mean from the prior year, obtaining the difference in degrees Celsius between year *t*-1 and the prior period.[6] Locally high temperatures might kill off a crop, while low temperatures might stunt its growth. Additionally, we use precipitation reprojections, again monthly means for March through September. We calculate the difference, in millimeters, between the one-year lag and the 60-year comparison sample. Unusually high precipitation can flood a crop or cause rot, and low precipitation can stunt or kill a crop. Any of these would contribute to subsistence pressures that would increase the likelihood of scapegoating.

[5] We do not use the climate deviation reprojections from Guiot, Corona, & ESCARSEL Members (2010) because they do not cover the Alps, creating missing data for some of our sample. In our analyses, we rely on materials and preprocessed data from Nicolas Gauthier.

[6] To be clear: the lagged March-September mean is for year *t*-1, and the comparison is with the mean and standard errors from the sample (*t*-1) to (*t*-61).

Governmental capacity

Governmental capacity may have protected some city governments institutionally from the social pressures that fostered witchcraft persecution. We focus on city independence as a proxy. We code whether cities were free (self-governing rights) or imperial (directly accountable only to the emperor) as a year-varying binary from Jacob (2010), which applied to 44 of the cities. Relatedly, cities in the Hanseatic League were often functionally independent and governed by mercantile elites. We code binary Hansa membership from Pagel (1994); 84 cities in the sample were ever Hansa members during the study period. Hansa membership and free or imperial status were not mutually exclusive. In about 30% of the years that a city was free or imperial it also belonged to the Hanseatic League; only about 9% of the years that a city was in the League was that city also a free or imperial city. In both cases, it would have been more likely that a city had local legal experts, who might have been more hesitant to adopt the counter-normative standards of evidence and inquisitorial practices advocated in the *Malleus*. Finally, cities ruled by bishops might have intervened to tamp down on witch trials, which, as secular processes, displaced inquisitorial institutions and challenged Church authority over supernatural interpretation. Relying on Cheney (1996), we categorize cities by whether they were administrative centers of bishoprics and archbishoprics or not (91 total).[7]

We add one further measure as a spatial control. The spatial distribution of historical data about witch trials, as collated by Leeson and Russ (2017), is uneven. As suggested by Figure 3,

[7] If a city converted from Catholicism to Lutheranism, the Catholic bishop might become a Lutheran bishop. But Lutherans followed a different model of collaboration between religious and secular authorities, and secular exercise of authority did not undercut Lutherans in the same way as Catholic bishops. Lutheran bishops (or superintendents) were appointed by secular authorities.

the Rhineland may be overrepresented, based on the geographic scopes of the underlying source studies. To control this possibility, we construct a dummy variable based on latitude and longitude that encodes whether a city lies outside of the high-coverage area (1) or not (0).

We do not include any population measures in the main models beyond those estimated through sample selection. Precise estimates are unreliable over long time ranges. In addition, our measures of trade network centrality also proxy for population size, and centrality and population are collinear. Further discussion, and results including a population estimate, can be found in the appendix.

Table 1. Descriptive statistics, n = 125,163 city-years

	Min	Max	Mean	Median	St. Dev.
Year	1400	1650	1519.67	1517	72
First trial	0	1	0	0	0.03
People tried	0	219	0.01	0	0.67
Malleus editions, past 10 years	0	7	1.09	0	1.73
Malleus editions, distance-weighted	0	9.70	0.06	0	0.12
All text editions, past 10 years	0	17	3.48	2	4.40
All text editions, distance-weighted	0	13.53	0.19	0.07	0.29
Total persons tried, past 10 years	5	2,029	299.75	63	437.47
Total persons tried, distance-weighted	0.08	292.15	15.30	3.22	23.08
Degree	0	18	3.02	2	2.48
Betweenness	0	0.20	0.01	0	0.02
Eigenvector	0	1	0.03	0	0.10
Battles, past 10 years	0	154	12.46	0	24.82
Battles, distance-weighted	0	288.14	5.62	0	18.56
Relative temp. (Celsius)	-2.91	3.50	-0.03	-0.06	0.81
Relative precip. (mm)	-49.77	73.94	-0.10	-0.54	12.74
Hanse member	0	1	0.14	0	0.35
Free or imperial	0	1	0.04	0	0.20
Catholic seat	0	1	0.14	0	0.34
Low-coverage area	0	1	0.23	0	0.42

Method

Because we do not maintain that books were the original cause of witch trials but rather that printing of witch manuals increased the breadth of witch-hunting, we focus our analyses on the period between 1400 and 1650. This chronological scope spans several decades before the appearance of *Malleus maleficarum* until the end of the USTC data. Consequently, we can observe whether publication of *Malleus* and other demonological texts independently contributed to the diffusion of persecution net of spatial diffusion and other factors.

We model trials by city-year as a distribution of spatial and temporal variation in demonological printing, prior witch trials, and confessional battles; exposure within the city network; and local, jurisdiction-specific measures of climate and government capacity. Because the majority of our observations are city-years with no trials, our outcome variable is a zero-inflated binary, and we choose Markov Chain Monte Carlo Bayesian logistic regression to estimate our models. Using a Bayesian approach helps to deal with non-normality in all the variables because we can choose the shapes of the prior probability distributions we use. We use a Student's t distribution (df=7, scale=2.5) for the parameter estimates for the dependent and independent variables (Lemoine 2019; McElreath 2020) because this distribution asserts a central tendency while maintaining more room in the tails, allowing for the more dispersed nature of the data (Betancourt 2017; Gelman et al. 2008; Stan Development Team 2018). In addition, we rescale the continuous independent variables to be centered on their means with one unit equal to one standard deviation.

Our specification is hierarchical, pooled by cities, because our sample is fundamentally a time-series regression and because we want to account for unmeasured city-level variation that

may not be consistent across the three centuries of our sample (Gelman and Hill 2007; McElreath 2020). We use city-specific random intercepts with the narrower Student's half-t distribution (df=4, scale=1) for the intercept priors (Gelman 2006) because we do not expect much city-specific variation.

We estimate each of our models using the brms package for R (Bürkner 2018) with a warm-up of 1000 iterations, and 4000 iterations total, on each of 4 chains. To curb divergent transitions, we tune the proposal acceptance rate to 0.9. Diagnostics did not detect any problematic behavior (no divergent transitions). Full details and results are provided in the appendix.

Quantitative Results

Model 1 evaluates the three main hypotheses together. Results are presented in table 2 and visualized in figure 4. We use 89% credibility intervals, following McElreath (2020). Because estimations were performed with rescaled data, for continuous variables the units are the variables' standard deviations.

Overall, despite the popular image of a "witch craze" sweeping Central Europe, witch trials were unusual events. The odds of a city holding a witch trial in any given year were small. The results provide clear support for our three hypotheses. First, cities closer in time and space to the publication of the *Malleus* were more likely to commence witch trials (H1), seen in the positive posterior mean for *Malleus* editions in the past 10 years. Our results provide evidence in support of ideational diffusion in that the elaborated concept of witchcraft and the secular inquisitorial procedures it endorsed spread partly because of new print media. We find that a trial was more likely when more editions of *Malleus* were recently printed, but we find no

relationship with the distance to where the editions were printed. The odds of having a first trial increases 29.7% with increasing the number of editions in the past 10 years from the mean (1.09) to one standard deviation higher than the mean (2.82).

Table 2. Results from Bayesian logistic regression

	Model 1		
	Posterior mean	89% CI	
Malleus editions, past 10 years	0.26	0.03	0.55
Malleus editions, past 10 years, distance-weighted	-0.13	-0.46	0.07
Total persons tried, past 10 years	-1.05	-1.45	-0.66
Total persons tried, past 10 years, distance-weighted	1.23	0.93	1.54
Degree	0.24	0.11	0.37
Betweenness	-2.05	-7.53	2.39
Eigenvector	2.47	0.36	4.69
Battles, past 10 years	1.28	0.73	1.84
Battles, past 10 years, distance-weighted	-1.60	-2.54	-0.79
Deviation of prior growing season precipitation	-0.02	-0.17	0.13
Deviation of prior growing season temperature	-0.09	-0.23	0.05
Hansa membership	-2.12	-3.19	-1.15
Free or imperial	1.56	0.59	2.55
Catholic seat	0.68	-0.04	1.42
Low coverage area	-0.97	-1.69	-0.29
Intercept	-9.41	-10.29	-8.65
Random effects: 553 cities			

Note. The temporal and spatio-temporal measures were scaled around their means, and therefore the estimates apply to a one-standard-deviation change rather than a one-unit change.

Second, cities closer in both time and space to trials held elsewhere were more likely to hold trials themselves (H2). Social reinforcement had a neighborhood-specific role in determining where witch trials occurred in late medieval and early modern Central Europe. We observe a classic pattern of social diffusion in that trials influenced the occurrence of subsequent

trials. The negative temporal lag paired with the positive spatiotemporal lag indicates that trial onset was unlikely unless there were more trials held nearby.

Third, more socially connected cities were more likely to begin trials (H3). We do not find that betweenness centrality is associated with staging witch trials. That is not surprising because, in the context of a trade-route network, betweenness captures the extent to which each city lies on the shortest path between all other actors in the network. It thus is a better measure of efficient exposure to trade (e.g, by virtue of location on a waterway), rather than of exposure to social influence. Other social relations mediated by trade-ties are associated with greater odds of trials. Consistent with the idea of percolation, we find that cities with a greater number of network neighbors, that is, cities with a greater number of ties to other cities in the trade network (degree centrality) were more likely to hold a trial. The marginal change from the mean to one standard deviation above the mean in degree centrality is associated with a 27.1% increase in the odds of a trial. Even more telling is the association between eigenvector centrality and the odds of witch trials. Eigenvector centrality, which measures whether a city is highly connected to other highly connected cities, was positively and strongly associated with trials; cities with scores one standard deviation above the mean had 1082.25% higher odds of starting witch trials.[8] In the context of the trade-route network to which cities belonged, it suggests that ties to more central actors are more politically important than ties to peripheral cities and subject to greater elite pressure to conform to the innovation of witch-hunting.

[8] We include all three centrality scores in the main specification, despite correlations among them (especially degree and betweenness). Isolating them in three separate specifications does not change the main results, though the magnitude of the eigenvector coefficient doubles (2.47 to 5.14) and the credibility interval improves. Our models including all three centrality measures are comprehensive but conservative estimates.

In line with Leeson and Russ (2017), we find evidence that direct exposure to Protestant-Catholic religious conflict increased the odds of witch trials. However, we find that nearby confessional battles depress the occurrence of a trial. We do not find support for the scapegoating theory that natural calamities that adversely affected agriculture increased the odds of witch prosecution (Erikson 2005 [1966]; Jensen 2007; Oster 2004). Neither locally adjusted temperature nor precipitation variation increased the probability of a trial, at least not in cities.

Finally, we find mixed evidence for the local governmental capacity argument. Whereas free and imperial cities were more likely to hold trials, cities in the Hanseatic League were less likely. Free or imperial status, denoting autonomous governance exercised through civic institutions, is associated with increasing the odds of a trial by 475.8%. The odds for starting witch trials under the commercially-minded governance of Hanseatic League cities was 82.0% lower than for non-members. Hanseatic cities clustered in the north and east of German lands, more remote from the places where the *Malleus* was published and, after the Reformation, farther from the frontlines of confessional conflict. Additionally, the seats of bishops or archbishops were neither more nor less likely to try accused witches.

In the appendix, we present additional specifications. From varying the time lags to 5 and 20 years, we learn that the *Malleus* did not have an immediate relationship to trials, but, consistent with the percolation mechanism, people needed time to read it and circulate its ideas before holding their first trial. Expanding from the *Malleus* to include nine other witch-hunting manuals does not change the results and does not improve the precision of the estimations; we capture the entirety of the relationship to printed manuals by measuring the *Malleus* alone. We also re-estimated model 1 with only the temporal measures and then only the spatiotemporal measures; the results align with those for model 1.

We acknowledge possible endogeneity between the demand and supply of witchcraft persecution. The historiography of witchcraft suggests that a latent demand for persecution was common in late medieval and early modern society. It is possible that printers published editions of the *Malleus* and other like books because they anticipated a market for those books and thus responded to a demand for persecution. However, only five of the nine cities where the *Malleus* was printed had trials, and three of those did not have trials after 1489. One city has no trials recorded in the Leeson and Russ data. If local demand drove printing, we should have seen more trials in these cities, and conceivably more cities where the *Malleus* was printed.

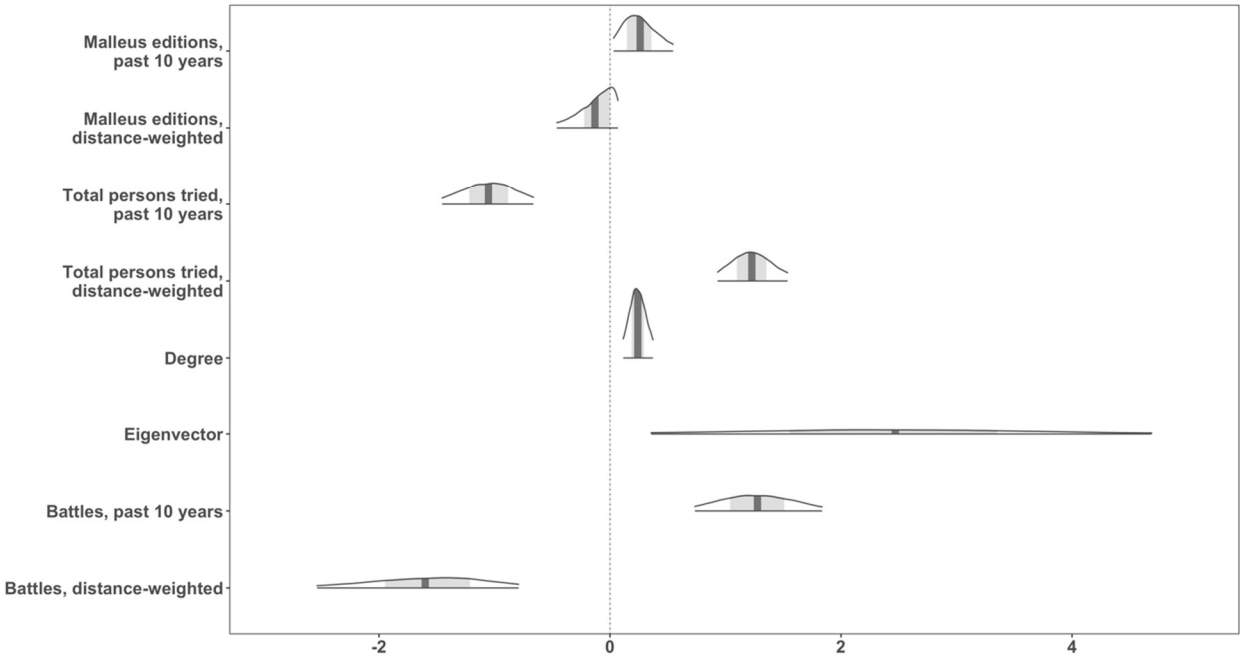

Figure 4. Selected first differences in log-odds of beginning witch trials, with 50% and 89% credibility intervals.

Note. Differences for lagged variables are for a one-standard-deviation increase.

Additional Evidence: Historical Evidence Connecting Ideas to Practice

Historical accounts bolster our quantitative analysis by illustrating how a new theory and practice of witchcraft prosecution triggered waves of persecution. From the book's inception, religious zeal and ambition combined to empower a new class of ideological entrepreneurs skilled at justifying and conducting persecutions at the behest of embattled or insecure rulers. The new witch-hunting officialdom grew in ranks, sharing rationales and practices, and fanned out across the region.

Prior to the publication of the *Malleus,* Heinrich Kramer had established a controversial record as an inquisitor and persecutor of witches (Jerouschek 2006). As a recognized expert on conducting inquisitorial procedures, in fall 1484 Kramer visited Ravensburg on the summons of a local chaplain to advise in the investigation of a group of women accused of causing weather anomalies and an outbreak of plague (Schmauder 2017; Schmauder and Behringer 2001). His investigation led to the conviction and execution of two of them. Flush with success and enjoying Kramer's mentorship, the local chaplain received a recommendation from Rome as a notary for inquisitions. With this in hand, he secured a better clerical position in nearby Isny, from whence he promoted an extensive witch hunt in the Bishopric of Konstanz that ultimately tried and executed dozens of accused witches. Framed through our model of ideational diffusion, the local chaplain had already adopted the elaborated theory of witchcraft. His involvement in the Ravensburg process gave him credibility in a neighboring town and, eventually, the region. On a local level, influential individuals were convinced to re-interpret witchcraft and therefore to take on new behavior.

Previously, Kramer had faced opposition and criticism for baseless persecution. The success at Ravensburg now encouraged him. Indeed, the subsequent publication and republication of *Malleus* succeeded in legitimizing persecution far beyond what Kramer in

person had done. The publication of the book fostered the spread the elaborated theory from Dominican theologians to the wider world of clerics and secular magistrates (Ben-Yehuda 1980). In terms of our model, the book and the elaborated theory now moved from inception to percolation (see figure 2). For example, magistrates are known to have been consulting the book as early as 1489, when Nuremberg's city council weighed witchcraft charges against local residents (Behringer 1997:73). The book's influence radiated in waves; after a renewed series of printings in the second half of the sixteenth century there was another wave of persecutions inspired by the book. For example, in Trier in the early 1580s local authorities explicitly used it to justify and conduct trials (Rummel 2020; Schormann 1996:33).

Over time, the influence of the book grew, partly because it inspired further books on the subject, but also because its teachings provided a set of learned doctrines taken up by a new generation of officials specializing in the suppression of witchcraft. As rulers observed other towns engaging in witch hunts, they considered investigating witchcraft in their own towns. The *Malleus* provided a module of techniques that could be adapted to local conditions. "*Malefizmeisters*" and "*Hexenkomissare*" presented themselves as learned experts who rulers could appoint to preside over campaigns of persecution; their appearance marked a transition from percolation into widespread adoption (see figure 2). The histories of many large-scale persecutions across Germany in towns such as Wiesensteig (1562-3), Trier (1581-93), Osnabrück (1583), Fulda (1603-6), Würzburg (1625-31), and Bamberg (1627-32) implicate this new class of experts steeped in the theory and practice of demonology (Heuser and Decker 2014; Schormann 1996).

In sum, the *Malleus* provided the ideological foundation for persecution and proffered diagnostic tools taken up by investigating magistrates. It brought the new conception of

witchcraft to a wide circle of literate people, easily crossing Christendom's confessional divides in the process (Mackay 2006a:33).

Discussion and Conclusion

We have argued that ideational diffusion drove the great European witch hunt. Our findings show that the persecution of witches spread among Central European cities by changing ideas propagated by printing, by geographical proximity to cities that had adopted witch-hunting, and by the connectedness of cities to each other through trade routes.

The printing press did not cause the inception of the elaborated theory of witchcraft, but our results show that it fostered its spread. We find that the printing of witch-hunting manuals led to new cities taking up witch trials, though the size of the association is modest. This probably reflects the limitations of our data source on printing: it only reports the place and date of publication but not the number of copies of the *Malleus* and their subsequent spatial distribution through the book trade. Were the measure more precise, we would expect that the association between printing the manual and the spread of trials would be greater.

We acknowledge that distance to a printing city is a rudimentary proxy for the spread of an idea. Nearby to such cities were many possible ideas, as seen in the small proportion of total printed texts in those cities that were witch-hunting manuals. The likelihood of any one of them becoming adopted by elites who could implement new behaviors was small. On the technical side, some of the printing cities were more remote from our sample of cities. Without data on their own neighbors outside our geographic scope, we are underestimating the possible spatial pattern. By contrast, the proximity of other trials is a straightforward way that information about trials could spread through trade networks, and it is not surprising that it has a larger association

with the incidence of trials. Our research design is thus a hard test of our theory of ideational diffusion. Importantly, the benefit of printing books is that they can travel, and the ideas in them spread, to greater extent than social influence from one's neighbors. A book like the *Malleus* has less decay to its reach because it is in fact more mobile, and the quality of the information provided by it does not change with distance from where it originates. That any variance in persecution is explained by the independent effect of printing the *Malleus* -- *net of intercity material and social exchange* -- is strong support for our theory.

The great witch hunt grew from a collision between traditional, popular notions of sorcery and the increasingly literate, standardized culture of confessional Christianity (Hoak 1983:1273). This makes witch-hunting an outgrowth less of ignorant superstition but rather of the new "culture of the book" enabled by the print trade. As product of that culture, the *Malleus* has several features that help explain why it altered literate opinion about witchcraft and spurred judicial action. It was innovative, synthesizing popular superstition with learned ideas about supernatural dangers. It appeared to be legitimate, endorsed by influential actors, including eminent theologians, the pope, and the emperor. Finally, it was practical, providing a template that made it easier to adopt witch-hunting and to cultivate a new class of moral entrepreneurs and witch-hunting officials.

Although our results are consistent with the confessional competition hypothesis, the countervailing trend for distance to confessional battles calls the strong form of this argument into question. An alternative interpretation is that religious social change prompted both confessional conflict and witch trials. And we do have a candidate change that would have motivated both: new demonological ideas that portrayed everyday life as part of an apocalyptic struggle between good and evil, a contest in which proper belief, religious unity, and *governance*

were of greater importance than ever before and placed enormous new burdens on rulers (Hall 2009). Future research should explore the connection between new theological ideas of social order and good governance as sources of political innovation (see, e.g., Becker, Pfaff, and Rubin 2016).

Our operationalization for climate-related scapegoating has improved measurement validity over existing studies, yet we find no relationship between the onset of witch trials and climactic variation. Other recent research similarly questions the usefulness and the validity of climate measures as commonly used by social scientists (Mellon 2021; Werum and Ratcliff 2022). At first glance, the vagaries of climate appear to be a good addition to statistical models, but there is considerable social meaning-making between year-over-year climactic change and social outcomes like witchcraft accusations.

European witch trials were organized procedures. Our findings are in line with research on religious persecution (Johnson and Koyama 2014, 2019) as well as on other activities organized by early modern governments, such as fostering religious reform, confessional conformity, and imposing ethnic and cultural homogeneity (Becker et al. 2016; Doten-Snitker 2021; Kulkarni and Pfaff 2022). Our findings suggest that future research in the vein of Johnson and Koyama (2019) and Doten-Snitker (2024b) comparing different types of legal institutions and governing organizations might continue to improve our understanding of the supply-side of persecution.

Applied to the great witch-hunt, our model of ideational diffusion goes beyond existing material explanations by showing how new ideas and worldviews matter in explaining cultural change. Diffusion models can make learning itself seem mechanistic, as if machine learning is the default: taking in information, amalgamating it, and producing a judgment, in a way that

appears replicable, stable, and relatively immediate. On the contrary, actors can take some time to consider new information, perhaps eyeing others or conferring with them, in a way that does not match the temporality of an exposure-based contagion model. Speaking of "re-interpreting the social world" allows us to broaden just what might happen as actors receive information about a new idea. Unlike some formulations of diffusion-as-learning, learning as re-interpreting the world may have little to do with straightforward utility. In our theory applied to witch trials, actors become convinced that another view of the interaction between spiritual and physical realities is consequential and plausible enough that they should adopt new legal procedures in line with that view. Yet our understanding does not require that adopters are convinced that the new theory generates better goods, only that the new worldview demands urgent action.

Data Availability Statement

The data on witch trials from Leeson and Russ (2017) underlying this article are available at https://doi.org/10.1111/ecoj.12498. Additional data and replication materials will be made available in the [Harvard Dataverse or SocArXiv], at https://dx.doi.org/[doi].

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