



Prehistory to History: A New Archaeological Approach to Knowledge Transmission and the Inception of Literacy in Central Europe

Jiří Macháček¹ 

© The Author(s) 2024

Abstract

This paper reviews archaeological research on the transmission of writing knowledge between literate and pre-literate societies. It proposes the use of productive approaches, such as cultural epidemiology and cultural attraction theory (CAT). The case study focuses on East-Central Europe and discusses the role of writing in the construction of social group identity and the transition from local communities with a prehistoric mindset to a historically acting society during the first millennium AD. The study collects relevant archaeological records of Early Mediaeval writing and explains them using reflective archaeology. It is shown that interactions between literate and pre-literate societies are highly complex social processes that function not only at the cultural and cognitive levels of individuals but also among larger groups of people. By combining cultural attraction theory with empirical archaeological data, this study formulates a conclusive explanation for the introduction of writing among Europe's Slavic-speaking population.

Keywords Cultural Epidemiology · Cultural Attraction theory · CAT · Writing · Early Middle Ages · Slavs · Runes

Introduction

For at least the last two decades, archaeologists have been interested in how knowledge is transmitted and how to recognise the forms of this transfer. This research involves collaboration between archaeology and cognitive sciences such as psychology, biomechanics, and neuroscience. Current studies provide various methods for

✉ Jiří Macháček
machacek@phil.muni.cz

¹ Department of Archaeology and Museology, Masaryk University, A. Nováka 1, Brno, CZ 602 00, Czech Republic

determining individual variability in artefact production, such as lithic industry or pottery, or how novices and children acquire new knowledge (Forte et al., 2023). However, a strong theory of knowledge transfer among larger groups of people with different backgrounds and habitus is still needed.

Archaeologists are, therefore, looking for the most productive ways to explain these cognitive processes, which play a fundamental role in the development of human culture. An excellent example is the transmission of writing between literate ('historic') and pre-literate ('prehistoric') societies that occurred at different times and in different parts of the world, for instance, in the Aegean from Minoan Crete to Mycenaean Greece, or in Mesoamerica from the Olmecs to the Zapotecs (Boyes et al., 2021; Marcus, 2006).

The invention of writing has been seen from a top-down perspective as a means to legitimise the right of rulers to rule (e.g. in Classic Maya states), to keep economic records in early states (e.g. in Mesopotamia) (Marcus, 2006, p. 16), or to create a special privileged class (Goody, 1968). While this explanation may be suitable for 'primary scripts' that emerged *ex nihilo*, it is not entirely satisfactory for 'secondary scripts' that developed in a context where the concept of writing was already known. Recently, scholars have started to focus on the development of secondary scripts. However, there is still a lack of theoretical and comparative approaches to explore this phenomenon (Nash, 2021, pp. 223–225). Currently, the framework for understanding the processes of script adoption is primarily linguistic, as seen in the models developed by Peter Daniels (Nash, 2021, p. 224). Alternatively, some approaches, such as Material Engagement Theory, focus on the behavioural, psychological, and material interaction between individuals over time (Overmann, 2021, p. 56). However, to explain cultural evolution at the level of larger groups of people in a testable way, a more complex natural-scientific approach is required.

Cultural attraction theory (CAT) (Heintz et al., 2019), which is a part of cultural epidemiology (Sperber, 1996), may offer a solution. This theoretical, strictly materialist (Sperber, 1996, p. 26), framework is robust and enables scientists to analyse and explain the distribution of cultural markers, such as language, ideology, or code, including writing systems, which have an obvious material aspect (Claidière et al., 2014; Martin & Sørensen, 2011, pp. 1–10). However, *cultural epidemiology*, known also as the *epidemiology of representations*, remains a rare or even absent concept in European and world archaeology and anthropology. This is despite the fact that it is highly suitable for archaeology as a discipline that studies the human past or social processes through material remains (Neustupný, 1993, p. 5) or deals with things as such (Witmore, 2014).

The objective of this study is to show how effective this theory can be for archaeologists trying to explain why and how ideas, practices, artefacts and other cultural items spread in prehistoric and early historic communities. This study aims to demonstrate the productivity of a new approach by examining the transmission of writing between literate and pre-literate societies during the Early Middle Ages, focusing in particular on the transmission of writing between Germanic-, Latin- or Greek-speakers (and writers) on the one hand, and populations which spoke (but did not initially write) Slavic languages on the other hand. The Slavic-associated groups are considered part of the prehistoric world before the introduction of writing, because

their social model, as described by Parczewski (1991, 2004), reflects the specific prehistoric mentality rather than the historical behaviour of people like the ancient Romans or the medieval Franks. Following Tim Taylor's suggestion, I propose in this paper that we move beyond the disciplinary boundaries of prehistoric and medieval archaeology if we are to work on the broad syntheses of human history (Taylor, 2008).

'Slavs' is an ethnonym used in written sources for the population that appeared in Southeastern Europe in the 6th century and a little later in other parts of Europe. Following the glottochronological test, linguists assume that the Slavs lived initially to the north of the Carpathian mountains and around the source of the Vistula river. Due to migration, the Slavic-speaking population disintegrated in the 6th century into the western *Sclaveni* and southeastern *Antes/Antae* (Blažek, 2020), which were two early Slavic peoples described by Byzantine chroniclers such as Procopius and Jordanes (Heather, 2010, pp. 394–395). This assumption has been supported most recently by genetics (Olalde et al., 2023), which has proved that the presumed Slavic migrations followed by language shifts (Andersen, 2023) coincided with changes in the local gene pool (Peltola et al., 2023). The archaeological expression of the Slavic social model might be the so-called 'Prague culture' with Prague-type pottery (Parczewski, 1991, 2004). It can be argued that the cultural pattern and habitus of the Prague culture did not differ fundamentally from that which characterised many prehistoric societies, despite the chronological disjunction. Formal periodisation distinctions (as between prehistory, protohistory, history) should be irrelevant in explaining general social processes such as the transmission of knowledge. Distribution of the settlements of the Prague culture correlates with the area where a Slavic language was undoubtedly used in historically documented periods (Schneeweiß, 2020, p. 52).

It is widely believed that there was no systemic alphabet among Central European Slavs before the Byzantine mission to Moravia (the eastern part of what is nowadays the Czech Republic) in the 9th century AD (Hakyung, 2013, p. 128), when new 'artificial' alphabets were 'created' by St Constantin/Cyril to fit Slavic needs (Cubberley, 1996, pp. 346–347).

The only historical source that refers to some kind of Slavic writing from a period before Christianisation is the 9th-century Bulgarian writer monk Chrabr, who briefly mentions – in his work *On the Letters*, written in Old Church Slavonic – that pagan Slavs used 'lines and cuts' or 'tallies and sketches' (Ohijenko, 1964):

Being still pagans, the Slavs did *not have their own books or letters, but read and prophesied* by means of *lines and cuts* (чрътанми и рѣзанми чьтѣхж и гадахж). After their baptism, they were forced to use Roman and Greek letters At last, God, in his love for mankind, ... sent them St Constantine the Philosopher, called Cyril, a learned and upright man, who composed for them thirty-eight letters, some similar to the Greek, but some different, suitable to express Slavic sounds ... (Bartoňková et al., 1969, p. 365–366).

The most popular interpretation is that these 'lines and cuts' were just that: counting signs or tallies, and not an alphabet. An alternative suggestion is that they might have

been a runic alphabet, but no concrete examples have been found (Cubberley, 1993, pp. 21–23).

What is surprising is the speed of later diffusion of writing into the population (Lunt, 2000), which indicates that the Central European Slavic-speaking population, or at least a part of it, had already been mentally well prepared to accept a script in the 9th century. The written records mention hundreds of disciples of St Constantine from that time (see *The Life of St Clement*) (Kalhous, 2012).

How did it happen that originally pre-literate or ‘prehistoric’ societies became literate and ‘historic’ in a short period of time? How did knowledge of writing transfer to Slavic-speaking people? Archaeology, underpinned by CAT and cultural epidemiology, is the only discipline that can answer such questions, given the scarcity of historical sources.

In this study, I have collected archaeological records of Early Mediaeval writing from East-Central Europe and have incorporated their analysis into a reflective archaeology framed by a new theoretical approach that must first be properly explained.

Cultural Attraction Theory (CAT) and Cultural Epidemiology as a New Approach to Writing Transmission

The transmission of writing from literate to pre-literate societies has usually been explained holistically, as a counterpart of macrophenomena such as Christianization. However, we can also understand literacy as an idea formative for human culture that is transmitted from one person to another over time and space, in a similar way to a contagious disease, by the cumulative effect of microprocesses and many individual events. As a natural-scientific approach, cultural epidemiology followed by CAT offers a different way of modelling cultural evolution and of explaining it in a testable manner (Sperber, 1996, p. 2). Hence, in this study, we aim to formulate an explanatory model of the transmission of writing that we can compare with the empirical data collected by archaeologists in East-Central Europe. Such a general model will facilitate the explanation of similar cultural processes that have led to the introduction of writing in various societies worldwide.

According to cultural epidemiology, inscriptions and other texts are typical public representations with a material aspect. Given the assumption that the epidemiology of representations is strictly materialist (Sperber, 1996, p. 26), this approach is well suited to archaeology. Accordingly, writing cannot only be the domain of historiography, palaeography or linguistics. We can develop materialistically plausible explanatory models of the transmission of writing within archaeology by following general epidemiological theory and using cultural epidemiology as a methodological framework to enable the study of the distribution of public representations and material cultural items (Heintz, 2011). According to this theory, chains of interaction—communication in particular—may distribute mental and public or general cultural representations (such as behaviours and artefacts) throughout a population (Sperber & Hirschfeld, 1999). The occurrence of scripts within pre-literate societies results from the transmission of such cultural representations.

According to Sperber (1996, pp. 32–33), cultural representations are a fuzzy subset of the set of mental and public representations inherent to a given social group (i.e. those educated to be literate) in regard to writing in a literate society. Mental representation exists within people in the form of memory or knowledge. Visible inscriptions are one possible form of public representation that exists in the human environment and works as a means of communication between the users and producers of texts. Such representations become cultural when they are widely distributed and entail long-lasting actions.

We must explain why and how writing becomes a relatively stable cultural representation in particular societies by answering the following question: what factors and conditions render repeated communication in written form more likely?

We believe that humans have the same genetically determined cognitive abilities and mental dispositions or susceptibilities (such that the potential to develop complex concepts, such as writing, is effectively universal). Of course, such ideas are challenging to understand. Appropriate environmental conditions are necessary for ontogenetic development and the transmission of new ideas. When encountering new concepts that they have not confronted previously and do not understand, people need to absorb such knowledge gradually. As Heintz (2011, p. 18) has noted, in such cases, people are not only learning new things but also learning to learn. The intermediate step toward complete understanding involves a metarepresentation—an idea that is initially only half-understood but helps one adopt a new concept. In non-literate societies, these could be tales, myths, or ritual practices (Sperber, 1996, p. 72).

In addition to psychological factors (individuals' cognitive and affective development), environment plays an essential role in such cultural evolution. Here, we refer to a set of the meanings, values, techniques, and collective cultural representations among a population, as well as ecological factors. Inputs from such an environment enrich individuals and enable their adoption of new concepts. Most historical changes are explained by interactions between individuals' psychology and environment (Sperber, 1996, p. 115). According to Heintz (2011, p. 18), 'people living in the same location are likely to experience similar circumstances, which evoke similar responses, whereas people living in different locations experience different circumstances that evoke different responses'.

The methodological core of culture epidemiology is CAT. This theory has been discussed in Heintz et al. (2019) and Scott-Phillips et al. (2018, p. 162). CAT is a useful tool for describing cultural dynamics and subsequent causal analysis. The main goal of this theory is to identify and characterise the cultural cognitive causal chain or pattern established by individuals' mental representations, such as personal knowledge of a script, and their public productions, including particular inscriptions, texts or signs. The mental representations and public productions constitute cultural tokens or items. If frequency of the cultural tokens in the causal pattern is relatively high and stable, they form a cultural attractor (e.g., a writing system), which is an abstraction of what these tokens share. The quantity of tokens within the causal chain may differ between generations, but they usually tend to cluster more in the following step due to the probabilistic favouring of some items over others. Various factors cause this cultural attraction, whether they are internal (psychological) or external (ecological). To provide a proper causal explanation of cultural dynamics, it is neces-

sary to identify the various attraction factors that stabilize items in clusters around attractors (Scott-Phillips et al., 2018, pp.163–171). From the archaeological point of view, a significant role in the explanation of cultural dynamics is played by ecological factors, including an organism's external biological and physical environment (such as population size or density), or by social factors, such as the behaviours or social action through which people interact (e.g. social networking). However, it is important to note that explanations of specific cultural phenomena, such as the introduction of writing to an illiterate society, must be case-specific rather than general.

To apply CAT to describe the transmission of writing knowledge between literate and pre-literate societies, it is necessary to define several time steps of the cognitive causal chain. This will allow for the modelling the movement of cultural tokens in one direction and final stabilisation of them when clustered around a cultural attractor, the new writing system (Heintz et al., 2019; Scott-Phillips et al., 2018).

- Step 0: Pre-literate society. The population occurs outside the pool of writing representations. People do not use any form of script in the pre-literate phase of the cultural evolution.
- Step 1: Enculturation. Cultural responses to a new environment start to operate and evoke the necessity of more effective forms of interpersonal communication – the writing system. Mental processes like learning enhance the introduction of writing into the pre-literate society. Significant tokens include new artefacts, technical devices or changes in social organization. Cultural knowledge is gradually accumulated. However, the new concept of writing is still not fully understood. People embed it in meta-representations, for instance, various ritual practices like prophecy and divination.

Which factors are essential for the enculturation and evocation of the writings?

- Step 2: Transmission of writings. Cultural stability has been reached by favouring some cultural tokens, such as inscriptions, texts, writing utensils, personal knowledge, and schools. An abstraction of what these tokens have in common is the cultural attractor. In our case, it is literacy and a specific writing system used in a society or a part of it. Writing is a new form of intra-group communication, and knowledge of it becomes a vital part of incorporated or embodied cultural capital. Some members of society wield power and gain benefits proportionate to their writing mastery. More complex social formations emerge as a result of new modes of communication and following integration between different social groups.

Which factors are at play during the stabilisation of the cultural items? How does writing affect the emergence of new social formations?

- (Step 3, occasionally): Loss of writing ability. Under specific circumstances, the knowledge of writing disappears from the culture. Cultural representations change back into meta-representations or are forgotten. The transmission of writing has failed or decelerated. The process must re-start from the beginning.

Why could the transmission of writing fail? What factors cause the loss of writing ability?

The main goal of the research is to compare this theoretical model with empirical data. Such items are artefacts from archaeological contexts—various objects with inscriptions, or writing utensils that reflect archaeological events, specifically, the interaction or communication between and within social groups (Fig. 1). We also need to identify the relevant attraction factors (Scott-Phillips et al., 2018, p. 165). From the archaeological point of view, a significant role is played by ecological factors, including an organism's external biological and physical environment, or by social factors, such as individual behaviour and social interaction.

Empirical Evidence in Archaeological Records: Inscriptions, Writing Utensils, Coins and Other Cultural Representations of Writing Among Central European Slavs in the Early Middle Ages

Germanic and Nomadic (Turkic) Runes or Runiform Inscriptions

The oldest known inscription, not only among Central European Slavs but throughout the Slavic world, is the bone engraved with Germanic runes from Břeclav-Lány (South Moravia, Czech Republic). We have established from archaeological excavation and scientific analyses that here, for the first time, an Elder Futhark (or *futhork*)

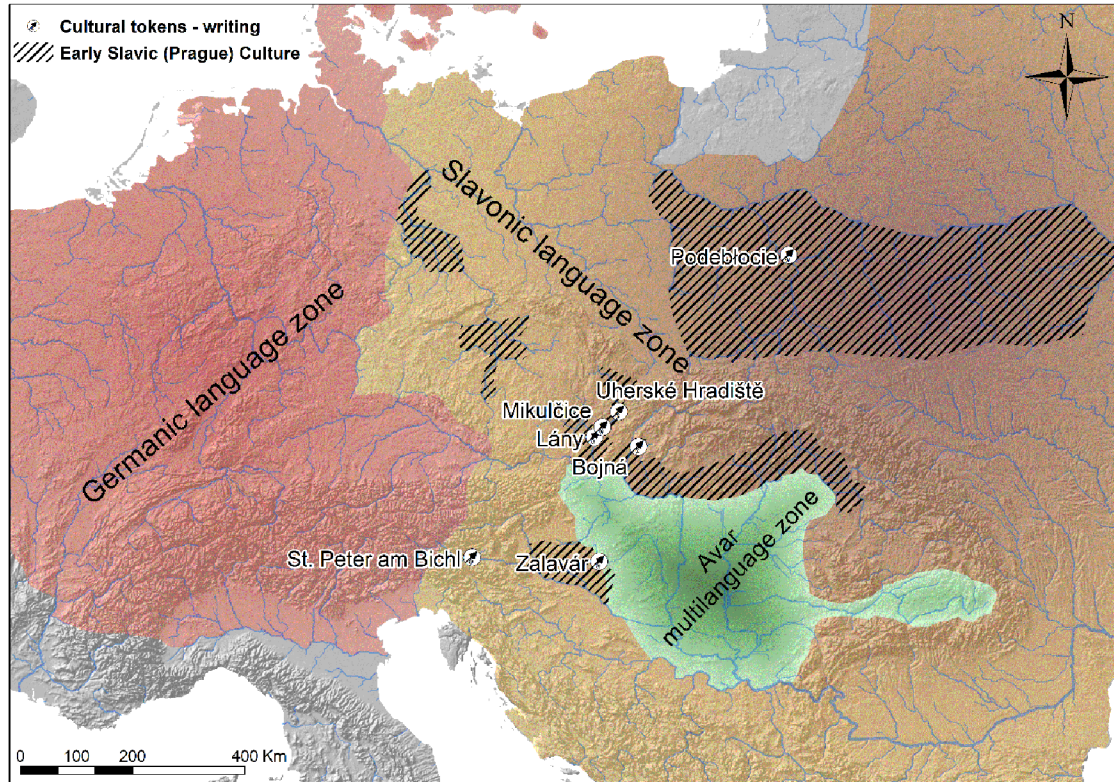


Fig. 1 Map of Central Europe around 800 AD, showing the main sites mentioned in the text where inscriptions or writing utensils have been found, together with presumed ethno-linguistic zones. Drawing by Jiří Macháček

inscription was discovered in a completely unexpected context, at a site classified as an Early Slavic settlement (Macháček et al., 2021) based on the form of the dwellings, pottery fragments characteristic of the Prague type (Parczewski, 1991, 1997), and radiocarbon dating (Botár, 2018; Kuna et al., 2013; Macháček et al., 2021; Pavlovič, 2017). There are only approximately 430 extant epigraphical texts in Elder Futhark, of which just under a hundred were found in continental Europe – the so-called South Germanic inscriptions (Düwel et al., 2020). This is a geographically defined term; confusingly, the languages of these inscriptions are exclusively West Germanic dialects such as pre-Old High German, pre-Old Saxon and Langobardic (Nedoma, 2006).

The carver was not too experienced and produced somewhat clumsy runes that are, however, clearly legible. This sequence renders six of the last eight runes in the Elder Futhark (*tbemlŋdo*), but it is unclear why the carver omitted the two runes *l* and *ŋ* between *m* and *d*. It must thus be assumed that the present inscription is incomplete (the animal rib was broken), and that the entire bone originally exhibited the characters preceding *t*. The erroneous omission of *l* and *ŋ* and the repeat engraving that has been detected are likely evidence of a writing exercise (Fig. 2). The runes could have been engraved by Slavic-speakers, who had learned the alphabet from Germanic people – most likely Lombards, who lived in the South Moravian region prior to Slavs. The Lombard and Slavic settlement here is almost directly continuous, with only a very small time gap (Kaizer et al., 2019).

We dated the sample of the runic bone inner section (Poz-99,473; uncalibrated age BP, range: 1455, 30) in the Poznan Radiocarbon Laboratory (on spectrometers 1.5 SDH-Pelletron Model) thanks to its relatively high bone collagen content: 7.1% collagen to 596–642 AD (68.2% CI) or to 568–650 AD (95.4% CI). The calibration of the date was made using the software OxCal - v 4.4.4 (Bronk Ramsey, 2021; Bronk Ramsey & Lee, 2013), with the application of the IntCal20 calibration curve (Reimer et al., 2020). According to this chronological model the bone with the runic inscription from Lány comes from a period, when the Slavs had already been settled in Moravia and the Lombards were already gone from Central Europe (Macháček et al., 2021). If any Germanic speakers remained, they are archaeologically almost invisible and fully assimilated with the new Slav population.

Not only Germanic but also nomadic (e.g. Avar) inscriptions are present in Central European sites classified as Slavic settlements. Avars – Turkic nomads from North-east Asia (Gnecchi-Ruscone et al., 2022), who came into close contacts with the Slavs after their arrival in Central Europe in the 6th century AD (Pohl et al., 2021) – also used letters called runes. The terms *rune* and *runic* should, strictly speaking, not be used for any other writing system except the Germanic Futhark (*futhark*). Nevertheless, the general term *runes* is often employed for any script that developed around the periphery of the Roman world in the first millennium AD. These scripts were by-products of cultural osmosis (Granberg, 2010). One example of runiform inscription (Szalontai & Károly, 2013, p. 365), is found on a bone plate from a composite bow of the Avar type that was found in Mikulčice (South Moravia, Czech Republic). As early as the 8th century, this place was an important centre of power (Poláček, 2008a). Later, in the 9th century, Mikulčice was probably the capital of Great Mora-

rune	ƿ	ᚢ	ᚦ	ᚨ	ᚱ	ᚷ	ᚹ	ᚻ
translit.	f	u	þ	a	r	k	g	w
phoneme	/f/	/u, ū/	/þ/	/a, ā/	/r/	/k/	/g/	/w/
number	1	2	3	4	5	6	7	8
name	* <i>fehu</i> ⁿ 'cattle'	* <i>ūruz</i> 'aurochs'	* <i>þurisaz</i> 'giant'	* <i>ansuz</i> 'áss, god'	* <i>raidō</i> 'riding'	* <i>kauna</i> ⁿ ? 'ulcer'	* <i>gebō</i> 'gift'	* <i>wunjō</i> ? 'joy'

rune	ᚱ	ᚳ	ᚴ	ᚵ	ᚶ	ᚷ	ᚸ	ᚹ
translit.	h	n	i	j	ī	p	z (r)	s
phoneme	/h/	/n/	/i, ī/	/j/	/i, ī/	/p/	/z/ (/r/)	/s/
number	9	10	11	12	13	14	15	16
name	* <i>haglaz</i> 'hail'	* <i>naudiz</i> 'need'	* <i>īsa</i> ⁿ 'ice'	* <i>jǣra</i> ⁿ 'year'	* <i>eih/waz</i> 'yew tree'	* <i>pirdraz</i> ? 'pear tree'	* <i>algiz</i> ? 'elk'	* <i>sōwulō</i> 'sun'

rune	ᚰ	ᚱ	ᚲ	ᚳ	ᚴ	ᚵ	ᚶ	ᚷ
translit.	t	b	e	m	l	ŋ	d	o
phoneme	/t/	/b/	/e, ē/	/m/	/l/	/ŋg/	/d/	/o, ō/
number	17	18	19	20	21	22	23	24
name	* <i>Teiwaz</i> a god	* <i>berkana</i> ⁿ 'birch twig'	* <i>ehwaz</i> 'horse'	* <i>mannaz</i> 'man'	* <i>laguz</i> 'water'	* <i>Ingwaz</i> a god	* <i>dagaz</i> 'day'	* <i>ōþi/ala</i> ⁿ 'property'

A



B

Fig. 2 **A** – The runes of the elder fuþark – normalized forms. After Nedoma (2003). **B** – Six runs of the elder fuþark on the bone from Břeclav – Lány (Czech Republic). Photo by Vojtěch Nosek

via – the Slavic polity (Poláček, 2014), where Slavic literature was supposed to have been invented (Večerka, 2014).

The bone plate was found in the lower layer of the stratigraphy associated with Avar objects (Kavánová, 1995, pp. 181–182, 320), which are generally dated to the 8th century (Poláček, 2008b, p. 585). Similar parts of composite bows have been found in Avar burial grounds, in 25 graves at five Slovak sites, which points to their

wide usage among this semi-nomadic community (Holeščák, 2019). On the other hand, they are rare outside Avar territory (Poláček et al., 2000, pp. 197–198).

The lateral tip plate of the Avar bow from Mikulčice was intentionally engraved above the string nock. There are at least four clearly visible symbols (Fig. 3b), similar to the other Avar runiform inscriptions of the (late) Avar period that are known to the researchers (Fig. 3a):

1. inscriptions engraved on 14 golden vessels found in Nagyszentmiklós (70 letters), which were the property of a princely Avar family in the 7th and 8th centuries (Bálint, 2010, p. 624);
2. inscriptions on the needle case from Szarvas (54 or 59 letters);
3. two bone plates from a bow found near Kiskundorozsma (12 letters); and
4. short fragments on various objects (altogether, 18 fragments with few letters) (László & Rácz, 1984; Róna-Tas, 1982; Szalontai & Károly, 2013).

The treasure of Nagyszentmiklós and the grave in Kiskundorozsma indicate that in Avar society a runiform script was probably used by the upper class and had sacral, religious functions (Szalontai & Károly, 2013, p. 392).

Traces of early Slavic contact with writing can also be found in other parts of the Slavic world, for example, in Poland, where three clay tablets with probable runic signs of the Turkic alphabet (or Latin script?) were found at the Early Medieval settlement in Podeblócie, dated to the 7th /8th centuries (Fig. 4). However, there has been no consensus as to whether these tablets may be products of the imagination of the archaeologists or a significant discovery (Buko, 2008, pp. 167–174).

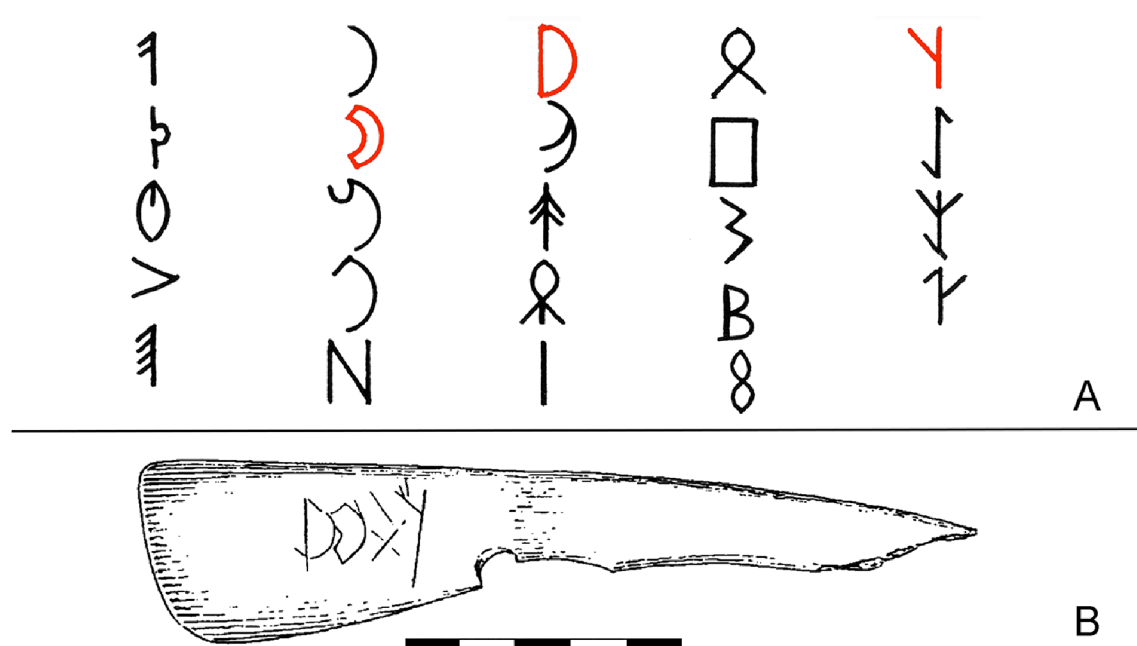


Fig. 3 Nomadic (Turkic) runes. **A** – graphemes engraved on golden vessels found in Nagyszentmiklós (Romania). **B** – plate of the Avar bow from Mikulčice (Czech Republic). 7th / 8th century AD. After Kavánová (1995). Drawing Archeologický ústav AV ČR, Brno v.v.i.

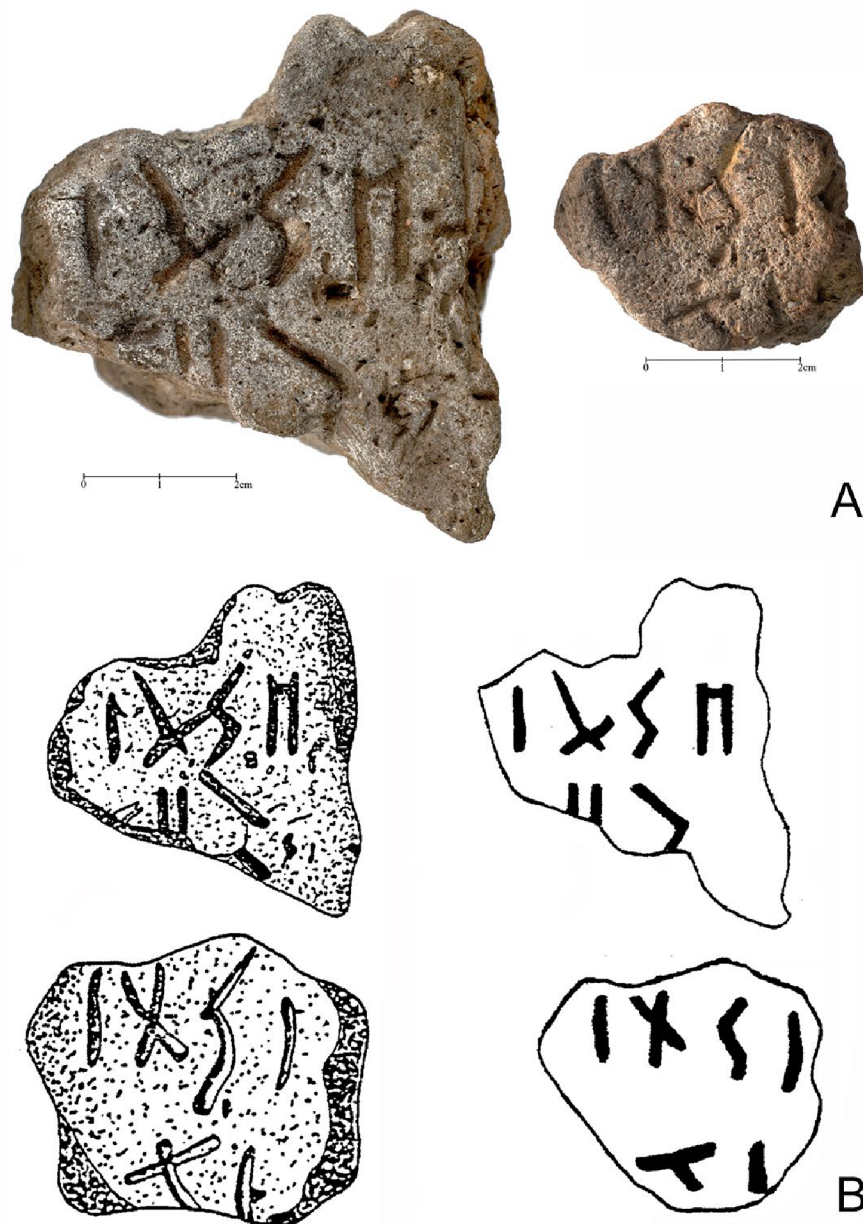


Fig. 4 Poblelocie (Poland) **A** – Tablets with signs engraved in two rows. Photo by M. Gmur. **B** – Two interpretations of the form of the signs from tablets (after T. Plóciennik). After Buko (2008). Reproduced with the kind permission of Andrzej Buko

Numerous runic inscriptions have been discovered in other Slavic territories, particularly in Bulgaria – where runes are associated with the Hunno-Bulgarians – and in the Kievan Rus, where Scandinavian runic inscriptions number more than 60. However, the runic inscriptions from both regions are much later, dating from the late 8th century onwards (Granberg, 2010).

Latin Letters

The Christianization of the Central European Slavs began in the first half of the 9th century in Moravian territory and slightly earlier in Carantania (Carinthia), a histori-

cal region and Slavic polity located in the Eastern Alps. The first missionaries were sent to these regions from the Bavarian part of the Frankish Empire. The Roman Church and Bavarian episcopate strongly supported the use of Latin letters by the Slavs, competing with the two Slavic alphabets – Glagolitic and Cyrillic (see below). The Latin alphabet was firmly established in large parts of Europe and had already become the dominant script among literate people in the Roman Empire (Kučera, 2014).

The Roman Church used Latin letters in both its liturgy and inscriptions on buildings or grave plates. One of the first inscriptions that is indisputably connected with Slavic elites is the braided stone reused (i.e. spolia) in the small church of Svt. Peter am Bichl, Carinthia, Austria. Two marble fragments bear inscriptions in Latin letters with the following names: OTKER · RADOZLA (V). These names are referred to as the church founders' inscriptions from the decades around 800. Otker is of West Germanic origin, whereas Radozlav represents a Slavic name (Eichert, 2019).

There are very few inscriptions written in Latin script in the territory of the former Great Moravia. They include a handful of isolated coins of North Italian or Byzantine origin (Kučerovská, 1998), but the most significant examples are the gilded figural plaques with inscriptions that were discovered at the Bojná I hillfort in Slovakia (Fig. 5). These, together with bronze bells, substantiate the Christian affiliation of the local community. According to dendrochronological data, the fortification of Bojná was erected in the last decade of the 9th century and was destroyed by a fire shortly thereafter (Hanuliak & Pieta, 2014; Pieta & Robak, 2017). These liturgical plaques may have been manufactured in northern Italy at the beginning of the 9th century and later imported into the territory of Great Moravia (Hanuliak & Pieta, 2014, p. 144).

Latin (as well as Arabic or Greek) letters were also present on coins that entered the Slavic zone of Central Europe as early as the 8th or 9th century AD, and occasionally even earlier (Adamczyk, 2020; Kučerovská, 1998; Militký, 2020).



Fig. 5 Latin letters on gilded figural plaques, discovered at the Bojná I hillfort (Slovakia). 9th century AD. After Hanuliak and Pieta (2014). Photo: Archeologický ústav SAV, v.v.i., Nitra (attached). Reproduced with the kind permission of Karol Pieta

Greek Letters

Both the Bavarian Catholic Church and the Byzantine Empire were involved in the Christianization of East-Central Europe. The most significant Byzantine involvement in this region in the second half of the first millennium was the mission of Saints Constantine/Cyril and Methodius in Great Moravia. The only relic that can be indisputably connected both with the brothers from Thessaloniki and their entourage is the lead cross with Greek letters from the site of Sady, near Staré město/Uherské Hradiště (Fig. 6). This pectoral features an engraving of Christ on one side and the Greek inscription *Jesus - Christ - Light - Life - Prevails* on the other (Vančo, 2008). The presence of Greek clergy in Sady has also been confirmed by finds of goblet lamps and other glass vessels, which had not previously been discovered that far north of the Alps. All these types were common in the eastern Mediterranean and Byzantine world and may represent the personal items of members of the church mission (Galuška et al., 2012, p. 91). Some scholars believe that the ecclesiastical complex in Sady—consisting of a cross-shaped church with a narthex and other annexes, a wooden hall building and an attached settlement—was an essential early mediaeval centre of Christianization as the seat of the first Moravian archbishop, Methodius (Galuška, 2014, p. 84). It is possible that some Slavs in the Balkans may have used Greek script to transcribe Slavic speech. This is also supported by the existence of several examples of ancient Bulgarian epigraphy (Hakyung, 2013). In Central Europe, however, there is no evidence of the transmission of Greek writing to the Slavic population.

Glagolitic Script

The oldest Slavic alphabet is indisputably the Glagolitic (Fig. 7a) (Marti, 2014). Since the 19th century, many authors have supported the idea that this was developed by St Constantine/Cyril the Philosopher, brother of Moravian Archbishop Methodius (Šafárik, 1853). Moreover, *On Letters*, by the monk Chrabr, mentions Constantine/Cyril as the creator of the complete Slavic script, which has 38 characters (Hetényi & Ivanič, 2021). If this is correct, then the Glagolitic alphabet did not evolve slowly from some other form of writing but was developed all at once in the city of Constan-

Fig. 6 Greek letters on the pectoralis from Sady near Staré Město/Uherské Hradiště (Czech Republic). 9th century AD. After Galuška (2014). Photo Moravské zemské museum. Reproduced with the kind permission of Luděk Galuška





A



B

Fig. 7 Glagolitic script. **A** – Glagolitic alphabet. **B** – Glagolitic letters engraved on the ceramic flasks found in Zalavár (Hungary). 9th century AD. After Szöke (2014). Photo © Hungarian National Museum. Reproduced with the kind permission of Béla Szöke and Agnes Ritoók

tinople in the year 863 AD for the Byzantine mission to the Slavs (Dvornik, 1970). However, the more popular view is that Glagolitic is based on Greek cursive forms, that is, since most Glagolitic letters can be derived from Greek letters, it seems that St Constantine/Cyril added only characters for non-Greek sounds (Marti, 2014). In any case, the Glagolitic alphabet was first introduced in Great Moravia and Carolin-

gian Pannonia (Kalhous, 2012). From there, the new script spread to other countries inhabited by Slavic-speakers (Cubberley, 1996; Mathiesen, 2014, p. 187).

The only archaeological discovery of the original Glagolitic script is a set of letters that is engraved on polished ceramic flasks found at the Hungarian site Zalavár, today's name for Early Medieval Mosaburg (Fig. 7b). During the 9th century, Mosaburg became the centre of Carolingian Pannonia. It was the seat and fortified manor of Priwina (Pribina) and his son Chezil (Kocel), Carolingian counts (dux) of Slavic origin. Constantine/Cyril, the creator of the Glagolitic alphabet, and Methodius arrived in Mosaburg some time in 866, traveling from Moravia to Venice. Chezil was happy to receive Constantine/Cyril and his brother. As the *Vita Konstantini* reads, 'Chezil, the ruling prince of Pannonia ... expressed his great joy in the Slav script; he himself learnt it, and gave him fifty pupils. In this way, they, too, learnt it, and he [Chezil] treated him with great respect and assigned him a retinue' (Szöke, 2014, p. 92). During the excavations in Zalavár, along with inscriptions, various writing utensils were discovered, which indicates active writing knowledge among the local Slavic speaking population and confirms the text on the legend (Szöke, 2014, p. 92).

Writing Utensils and Talismans Imitating Books

Not only inscriptions but also small archaeological finds attest to the transmission of writing. The most significant are bone and metal styli used in teaching writing (Fig. 8). Some examples of these have been found in the main central places of Great



Fig. 8 Writing utensils (styli). 9th century AD. 1 – 4 Staré Město/Uherské Hradiště (Czech Republic), 5 – Mikulčice (Czech Republic), 6 – 8 Zalavár (Hungary). After Kouřil (2014); Szöke (2014). Photo Archeologický ústav AV ČR, Brno v.v.i., Moravské zemské museum, © Hungarian National Museum. Reproduced with the kind permission of Luděk Galuška, Pavel Kouřil, Lumír Poláček, Béla Szöke and Agnes Ritoók

Moravia and Pannonia that are linked to the Byzantine mission of St Constantine/Cyril and St Methodius or earlier activities of the Bavarian church.

Styli are often found in the interior or in the immediate vicinity of churches with narthexes, such as Uherské Hradiště-Sady, church No. 3 in Mikulčice or the Church of the Martyr Hadrian in Zalávar (Galuška, 1996, p. 71; Kouřil, 2014, p. 448; Pouлік, 1975, p. 84; Szöke, 2014, p. 92). These annexes were added to older churches after the arrival of Constantine/Cyril and Methodius to Moravia (Macháček, 2014) and were probably used for educational and other activities (Vavřínek, 1963, p. 141; 2013, pp. 129, 213). However, styli have also been found outside church vestibules, for example, near the ducal palace at Mikulčice (Poláček & Marek, 2006, pp. 8–9) or in the ecclesiastical complex in Sady (Galuška, 1996, p. 71). Schools also existed in Moravia before the Byzantine mission's arrival (Galuška, 1996, pp. 71–72). Gorazd, the only Moravian disciple of the Thessalonian brothers whom we know by name, learned to read (and probably also write) in Latin from western priests (Vavřínek, 2013, p. 129). However, according to the Life of St Clement, there were hundreds of disciples of Methodius and Constantine/Cyril in Moravia. After the death of Methodius, they were sold as slaves to Jewish merchants (Macháček, 2021, p. 115). Later, styli also came to the northwestern Slavs (Gringmuth-Dallmer, 2011, p. 93). They are significant evidence of the teaching of writing and the beginnings of local Early Mediaeval literacy in general.

One piece of engaging evidence for literacy knowledge is a small pendant in the shape of a book cover made of gilded bronze or silver (Fig. 9). Three such pendants were found in Great Moravian graves in Mikulčice (Kouřil, 2014, p. 459). Their miniature covers cannot be opened, but texts might have been written, then folded, rolled or both, and placed inside a hollow cover. Unfortunately, any texts that may initially have been inside them did not survive until the time of excavation. The pendants could have contained semicanonical religious scripts or magical formulas. They must have been regarded as talismans, charged with the power of the holy books they imitated (Balcárek, 2012; Corsten, 1991).



Fig. 9 Pendants in the shape of a book cover from Mikulčice (Czech Republic). 9th century AD. After Kouřil (2014). Photo Archeologický ústav AV ČR, Brno v.v.i. Reproduced with the kind permission of Pavel Kouřil and Lumír Poláček

Discussion: The Introduction of Writing to Slavic-Speaking Populations Based on Cultural Attraction Theory (CAT)

Explaining the collected empirical data is the primary goal of our research. We aim to formulate an explanatory model of the transmission of writing to pre-literate societies as a causal chain of cultural tokens using CAT and cultural epidemiology. Specifically, we focus on the introduction of writing to Slavic-speaking populations.

The initial cultural token in this chain is the rune-inscribed bone from Břeclav-Lány. This is the earliest archaeological evidence for direct or indirect contact between the presumed ancestors of modern Slavic speakers and the phenomenon of writing (Düwel et al., 2020, p. 763). It was followed by many other instances.

It must be emphasized, however, that population interaction is always a highly complex process, as reflected not only in the growing evidence for genetic intermingling but also in the results of comparative cultural and cognitive analyses. According to cultural epidemiology (Claidière et al., 2014), causal chains of cultural tokens—of communication in particular—may distribute similar mental representations and similar public manifestations of interactions (such as behaviours and artefacts) throughout a population (Sperber & Hirschfeld, 1999). The occurrence of Germanic or nomadic (Avar and later also Hunno-Bulgarian) runes in a Slavic settlement would represent the transmission of a particular type of public cultural form (Sperber, 1996, pp. 24–25) across older divides, showing how the Slavs in Europe initially engaged with people who had knowledge of a runic script (Fig. 10). The first stage of this cultural transmission could certainly have happened quite quickly, within 70 years at most, as radiocarbon dating has confirmed.

The Slavs had not used any alphabet until contact with a new pool of cultural (public) representations in Central Europe occurred. This was probably (but not necessarily) due to migration, and the cultural input enriched their psychology. Cultural transmission is usually a result of the combined effect of countless micromechanisms of cognition and personal communication (Sperber, 1996, pp. 54–64). The rune-inscribed bone from Lány is thus a possible material expression of such interaction between particular persons—social actors or agents. The inscription may well have

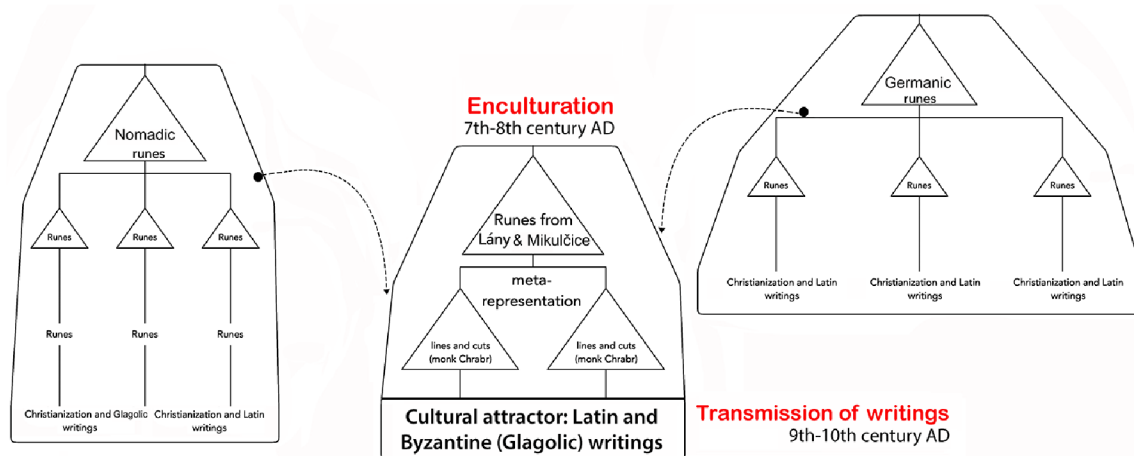


Fig. 10 The modelled transmission of writing to the Slavic population according to cultural epidemiology. Drawing by Jiří Macháček

been a writing exercise, facilitating the transfer of the knowledge of script between runemasters from the Germanic language zone, acting as communicators, and their Slavic pupils.

At first sight, the potentially revolutionary impact of such a cultural transmission on Slavic society in Central and Eastern Europe does not correspond with the number of inscriptions in Germanic runes that have been found in the Slavic language zone; thus far, there is only the bone from Lány. However, the cultural importance of public production is to be measured not by the number of copies in an environment but by their impact on people's minds (Sperber, 1996, p. 103). Knowledge of the runic script was initially restricted—presumably—to a narrow group of members of the highest-ranking elite (Düwel, 2015), and thus only several generations later did it spread to other social strata. Within Germanic-speaking populations, this transfer to a broader population took place as late as the 5th and 6th centuries, although the oldest runes, of which only a few examples survive, originate as early as the 2nd century AD (Düwel, 2008, pp. 23–24). Runemasters were always recruited from groups of people with excellent intellectual competence and high cultural capital (Dillmann, 2003).

Similar patterns may have been repeated among the Slavs, where the only difference is that the process of introducing the writing system began much later. In the 6th and 7th centuries, the social and intellectual elites in Slavic groups were only beginning to emerge (Eichert, 2017). These people later adopted the habitus of their Avar ruling class and thus, in addition to its customs and costumes, they encountered nomadic runes, as confirmed by the tip plate of the Avar bow with the inscription that was found in Mikulčice.

Runic letters, whether Germanic or nomadic, as a material representation of language, used to be considered ethnically based signals, especially given that such factors as language and writing competency are difficult to fake. The knowledge of writing can be mobilized as a weapon in the context of competition within and between social groups. The human subject, as a social agent, wields strength and gains benefits that are proportionate to his or her mastery of this objectified capital (Bourdieu, 1986). A specific script could undoubtedly serve as an ideal form of intragroup communication and cooperation or as a weapon in intergroup struggles. How is it possible that a script could be transmitted from one ethnolinguistic group to another, potentially hostile, group?

The underlying explanation could be derived from the political and cultural context of Early Mediaeval East-Central Europe. The settlements in Lány and Mikulčice, where such a cultural transmission has been archaeologically confirmed, were situated in an area that might be characterized as the boundary zone of three world systems—Germanic, nomadic and Slavic. At the end of the migration wave in the second half of the 6th century, this was a region of emerging, socially chaotic environments that were plagued with forced migration and social disruption. It was an environment of emerging social formations, of the creation of new modes of community integration among different mobile groups from diverse cultural backgrounds (Germanic Lombards, nomadic Avars and Slavs). Ultimately, this process led to local self-organization and new ethnic-group construction (Blanton, 2015; DeMarrais & Earle, 2017). A runic script, as along with other elements of cultural and ideological subsystems, could play an important integrative role in this process.

Although there seems to have been an amalgamation of the various Slavic, nomadic and Germanic groups, we have no clear evidence for the systematic use of runic texts among Slavs. For the Slavs, a runic script may have remained only at the level of so-called metarepresentation—an idea that was only half-understood, as reflected in the treatise by the monk Chrabr (no actual letter, but only ‘lines and cuts’ for divination). The apparent function of the ability to entertain half-understood concepts and ideas is to provide intermediate steps toward a complete understanding (Sperber, 1996, p. 72).

The full introduction of writing happened only after the spread of the new Christian alphabets (Latin and Glagolitic) among the Central European Slavs. Via the official confirmation in the Life of Constantine, the Central European Slavs did not have their own literature until the mid 9th century (Pukanec, 2020, p. 13). Sophisticated and widely usable writing systems were installed among Slavs by the Church and members of the local elites, as documented by inscriptions on the graves of the leaders of newly established polities, for instance in Carantania. The emergence of hereditary elite status groups thus changes our perspective from bottom-up to top-down. Nevertheless, the speed of the later diffusion of writing into the population (Lunt, 2000) indicates that the Central European Slavic-speaking population as a whole had already been mentally well prepared to accept a script. This process may have been facilitated by the Slavs’ previous experience with the older fuþark or nomadic runes. In the 9th century, script among the Slavs therefore shifted from metarepresentation to fully understandable cultural representation. The most important change after the conversion to Christianity was not obtaining knowledge about writing itself but the resulting new concept of literacy (Granberg, 2010, p. 44). Afterward, the cultural tokens, for example inscriptions on the sacred furniture of churches or devotional items or on ostraca and writing utensils, clustered around the cultural attractor, which is the final writing system. In East-Central Europe, this was the Latin script; in South-east and Eastern Europe, it was the Glagolitic and later Cyrillic alphabet.

Nevertheless, in some regions, such as Moravia in the 10th century, the ability to write eroded due to social collapse (Macháček, 2019). This was accompanied by a significant decline in population growth and fertility after the collapse of the whole system in the Post-Great Moravian Period (Galeta & Pankowská, 2023). The Early Middle Ages were highly politically dynamic, and the local social systems were somewhat unstable. The first Slavic polities look more like shadow empires that arose as a direct reaction to the imperial formations of their neighbours than stable states (Barfield, 2001). The fortifications were set on fire, the churches ruined, educated clerics and schools vanished and the script disappeared. The transmission of writing had temporarily failed, and the process had to start again from the beginning. In Moravia, literacy was fully re-introduced only in the 11th century.

Conclusion

By combining our initial model, based on CAT and cultural epidemiology, with empirical archaeological data, we can formulate the explanatory model of the introduction of writing to the Slavic-speaking population in East-Central Europe, which

offers a different way of modelling cultural evolution and explaining it in a testable manner (Table 1).

The Slavic speaking population had no contact with writing before 600 AD and did not use any form of script (Step 0). According to the prevailing theory, the presumed ancestors of modern Slavic speakers at that time were located in the territory of today's Ukraine and Belarus, outside of the pool of writing representations. Some archaeologists identify these people by a distinctive set of material remains. Their first archaeologically confirmed contact with the script is the runic inscription from the Lány site. Together with Nomadic runes from Mikulčice, the engraved bone from Lány documents the enculturation of illiterate Slavs through contacts with Germanic Lombards and nomadic Avars, which took place in the 7th and 8th centuries after the presumed migration of the Slavs into East-Central Europe (Step 1). The enculturation was a by-product of the local self-organisation of new ethnic groups. They emerged in socially chaotic environments plagued with forced migration and social disruption on the threshold of the Middle Ages. The runic script as well as other elements of cultural and ideological subsystems could play an important integrative role in this process. However, we have no clear evidence about the systematic use of runic texts among Slavs. For them, the runic script may have remained an idea that was only half-understood (meta-representation).

During the 9th century, writing became the means of social mobilisation in the form of incorporated or embodied cultural capital. The emerging Slavic ruling class (e.g. Radozlav from Carantania) engraved the first Latin letters on their tombstones or proprietary churches. The Church used written texts during Christianisation (e.g. the Byzantine mission of St Constantine and St Methodius in Moravia). The speed of diffusion of writing into the population, however, indicates that the Slavic-speaking population, or at least a part of it, had already been mentally well prepared to accept a script (see disciples of St Methodius and St Constantine and monk Chrabr),

Table 1 Introduction of writing to the Slavic speaking population. Description of cultural cognitive causal chain

Step	Status	Dating	Cultural tokens	Testable factors
0	Pre-literate society	Before AD 600	None	The presumed ancestors of modern Slavic speakers should be found <i>outside</i> the pool of writing representations in a territory where no contemporary inscriptions or writing utensils are known
1	Enculturation	7th – 8th century AD	Germanic and nomadic runes, Latin letters on grave plates	The Slavic speaking population encounters the pool of writing representations, probably as a result of <i>migration</i>
2	Transmission of writing	9th – 10th century AD	Inscriptions on furniture of Christian churches, Greek letters on devotional items, sherds that have inscriptions in Glagolitic script, styli, Holy Book imitations in the form of pendants	<i>Increase in the density</i> of social relations; <i>population size</i> has reached the critical point needed for successfully transmitting writing and skills accumulation due to intergroup interaction and communication

perhaps because of the previous experience with the fuþark or nomadic runes. The archaeological traces of writing and its appreciation, encouragement and dissemination tend to cluster. Among historically known Slavic-speaking populations two prominent writing systems were favoured: the Latin alphabet in Central Europe and the Glagolitic/Cyrillic alphabet earlier in Central and later in Southeastern and Eastern Europe. The process of the transmission of writing was successfully completed at this time (Step 2).

Cultural epidemiology, a natural-scientific approach, enables the testing of models of cultural evolution. In this way, we can formulate the design of future research by testing the various factors of cultural attraction. From the archaeological point of view, ecological, biological and social factors play a significant role. We have identified two main factors that were necessary for the transmission of writing: the migration of the presumed ancestors of modern Slavic speakers into a pool of writing representations in East-Central Europe, and an increase in population size and the density of social relations during the 9th century AD (Kuna, 2012, p. 20; Powell et al., 2009; Shennan, 2009). Archaeogenetic data attests to the significant migration event associated with the movement of Slavic groups at the beginning of the Medieval period (Olalde et al., 2023). The age-at-death ratio approach to estimating fertility in past populations, based on skeletal data, provides robust results indicating that growth and fertility rates increased during the politically and economically favourable period of the Great Moravian Empire in the 9th century AD (Galeta & Pankowská, 2023), when writing was transmitted to the Slavic-speaking population. Local self-organization and group identity-building also play a significant role in this process, as demonstrated by archaeological and written sources in the case of the Moravians.

Future research will focus on linking knowledge transfer with demographic events, such as migration, by studying genetic variability, including genetic discontinuity and population growth (Olalde et al., 2023; Peltola et al., 2023). Additionally, demography is an effective and independent method for testing factors that shape human behaviour, socio-cultural complexity and cultural ecology (Galeta & Pankowská, 2023). Therefore, the combination of archaeology, history, paleolinguistics, cultural epidemiology and archaeogenetics should effectively refine and advance our knowledge of cultural evolution, including the transmission of writing between literate and pre-literate societies.

Acknowledgements Author was supported by the Czech Science Foundation GA ČR (Project No. 21-17092X) ‘The Formation of Multi-ethnic Complex Societies in Early Medieval Moravia. Collective Action Theory and Interdisciplinary Approach (FORMOR): <https://www.phil.muni.cz/formor>.

Funding Open access publishing supported by the National Technical Library in Prague. Partial financial support was received from the Czech Science Foundation GA ČR (Project No. 21-17092X) ‘The Formation of Multi-ethnic Complex Societies in Early Medieval Moravia. Collective Action Theory and Interdisciplinary Approach (FORMOR)’.

Open access publishing supported by the National Technical Library in Prague.

Declarations

Competing Interests The author declares he has no financial interests. The author has no competing interests to declare that are relevant to the content of this article.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Adamczyk, D. (2020). *Monetarisierungsmomente, Kommerzialisierungszonen oder fiskalische Währungslandschaften? Edelmetalle, Silberverteilungsnetzwerke und Gesellschaften in Ostmitteleuropa (800–1200)*. Harrassowitz.
- Andersen, H. (2023). The Slavic expansion: Streams, springs, and wells. *Scando-Slavica*, 69(1), 39–87. <https://doi.org/10.1080/00806765.2023.2188609>
- Balcárek, P. (2012). A contribution to the discussions about the possible origin of certain pieces of jewelry shaped like book covers: Some suggestions to Zdeněk Klanica's article. *Eirene: Studia Graeca et Latina*, 48(1–2), 49–59.
- Bálint, C. (2010). *Der Schatz von Nagyszentmiklós: Archäologische Studien zur frühmittelalterlichen Metallgefäßkunst des Orients, Byzanz' und der Steppe*. Balassi Kiadó.
- Barfield, T. J. (2001). The shadow empires: Imperial state formation along the Chinese–nomad frontier. In S. E. Alcock, T. N. D'Altroy, K. D. Morrison, & C. M. Sinopoli (Eds.), *Empires: Perspectives from archaeology and history* (pp. 10–41). Cambridge University Press.
- Bartoňková, D., Havlík, L., Hrbek, I., Ludvíkovský, J., & Večereka, R. (1969). *Magnae Moraviae fontes historici. Vol. 3: Diplomata, epistolae, textus historici varii*. Universita J. E. Purkyně.
- Blanton, R. E. (2015). Theories of ethnicity and the dynamics of ethnic change in multiethnic societies. *Proceedings of the National Academy of Sciences of the United States of America*, 112(30), 9176–9181. <https://doi.org/10.1073/pnas.1421406112>.
- Blažek, V. (2020). Classification of Slavic languages: Evolution of developmental models. *Slavia Occidentalis*, 77(1), 33–64.
- Botár, I. (2018). Finally, Slavs! Early Slavic infiltration into the Eastern Carpathians. *Hungarian Archaeology*, 7(4), 30–35.
- Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258). Greenwood.
- Boyes, P. J., Steele, P. M., & Astoreca, N. E. (2021). *The social and cultural contexts of historic writing practices*. Oxbow.
- Bronk Ramsey, C. (2021). *Oxcal v4.4.4*. <http://c14.arch.ox.ac.uk>.
- Bronk Ramsey, C., & Lee, S. (2013). Recent and planned developments of the program OxCal. *Radiocarbon*, 55(2–3), 720–730.
- Buko, A. (2008). *The archeology of early medieval Poland: Discoveries–hypotheses–interpretations*. Brill.
- Claidière, N., Scott-Phillips, T. C., & Sperber, D. (2014). How Darwinian is cultural evolution? *Philosophical Transactions of the Royal Society B: Biological Sciences*, 369(1642), 20130368. <https://doi.org/10.1098/rstb.2013.0368>
- Corsten, M. (1991). Die buchförmigen Anhänger des frühen Mittelalters: Ein Beitrag zur Amulettenforschung. *Fornvännen*, 86, 183–189.
- Cubberley, P. (1993). Alphabets and transliteration. In B. Comrie, & G. G. Corbett (Eds.), *The Slavonic languages* (pp. 20–59). Routledge.

- Cubberley, P. (1996). The Slavic alphabets. In P. T. Daniels, & W. Bright (Eds.), *The world's writing systems* (pp. 346–355). Oxford University Press.
- DeMarras, E., & Earle, T. (2017). Collective action theory and the dynamics of complex societies. *Annual Review of Anthropology*, 46, 183–201. <https://doi.org/10.1146/annurev-anthro-102116-041409>.
- Dillmann, F. X. (2003). Runenmeister. In H. Beck, D. Geuenich, & H. Steuer (Eds.), *Reallexikon der Germanischen Altertumskunde* (pp. 537–546). de Gruyter.
- Düwel, K. (2008). *Runenkunde & (4th Edition)*. Verlag J. B. Metzler.
- Düwel, K. (2015). Runenkenntnis als Oberschichtenmerkmal (mit besonderer Berücksichtigung methodischer Aspekte). In O. Grimm & A. Pesch (Eds.), *Archäologie und Runen: Fallstudien zu Inschriften im älteren Futhark* (pp. 265–290). Wachholtz.
- Düwel, K., Nedoma, R., & Oehrl, S. (2020). *Die südgermanischen Runeninschriften* (Vol. 119). De Gruyter.
- Dvornik, F. (1970). *Byzantine missions among the Slavs: SS. Constantine-Cyril and Methodius*. Rutgers University Press.
- Eichert, S. (2017). 'Great men', 'big men' and 'chiefs' in Carantania? On the formation of elites and leadership/rulership in the Eastern Alps during the early Middle Ages. In G. Fusek (Ed.), *Archäologische Studien Zum frühen Mittelalter. Internationale Konferenz Nitra Vom 18. Bis 20. Oktober 2016* (pp. 15–26). Archeologický ústav SAV.
- Eichert, S. (2019). 'Founder tombs' in early medieval Carantania: A survey. In J. Macháček, & M. Wihoda (Eds.), *The fall of Great Moravia: Who was buried in Grave H153 at Pohansko near Břeclav?* (pp. 130–150). Brill.
- Forté, V., Castañeda, N., & Romagnoli, F. (2023). From novices to experts: Skill development and knowledge transmission in prehistory. *Journal of Archaeological Method and Theory*, 30(1), 1–8. <https://doi.org/10.1007/s10816-023-09601-0>.
- Galeta, P., & Pankowská, A. (2023). Population dynamics in the Middle Ages in Central Europe: Reconstruction based on age-at-death distributions of skeletal samples. *Journal of Archaeological Science*, 156, 105816. <https://doi.org/10.1016/j.jas.2023.105816>
- Galuška, L. (1996). *Uherské Hradiště-Sady: Křesťanské Centrum Říše velkomoravské*. Moravské zemské muzeum.
- Galuška, L. (2014). Christianity in the period of the Byzantine mission and the Archbishopric of Methodius on the basis of archaeological sources in the area of Veligrad–Staré Město and Uherské Hradiště. In P. Kouřil (Ed.), *The Cyril and Methodius mission and Europe: 1150 years since the arrival of the Thessaloniki Brothers in Great Moravia* (pp. 74–85). Institute of Archaeology of the Academy of Sciences of the Czech Republic.
- Galuška, L., Macháček, J., Pieta, K., & Sedláčková, H. (2012). The glass of Great Moravia: Vessel and window glass, and small objects. *Journal of Glass Studies*, 54(1), 61–92.
- Gnecchi-Ruscone, G. A., Szécsényi-Nagy, A., Koncz, I., Csiky, G., Rácz, Z., Rohrlach, A. B., Brandt, G., Rohland, N., Csáky, V., Cheronet, O., Szeifert, B., Rácz, T. Á., Benedek, A., Bernert, Z., Berta, N., Czifra, S., Dani, J., Farkas, Z., Hága, T., & Krause, J. (2022). Ancient genomes reveal origin and rapid trans- Eurasian migration of 7th century avar elites. *Cell*, 185(8), 1402–1413e1421. <https://doi.org/10.1016/j.cell.2022.03.007>.
- Goody, J. (Ed.). (1968). *Literacy in traditional societies*. Cambridge University Press.
- Granberg, A. (2010). Shift of written language and alphabet as part of the state formation process and the Christianisation (a comparative study of Bulgaria and Rus). In T. Stepanova, & G. Kazakov (Eds.), *Medieval Christianitas: Different regions, 'faces', approaches* (pp. 42–65). Voenno izdatelstvo.
- Gringmuth-Dallmer, E. (2011). Schriftkundige bei den Nordwest Slawen? In E. Kordiovský & F. Synek (Eds.), *Národní kulturní památka Slovanské hradiště v Mikulčicích a kostel sv. Markéty Atiochijské v Kopčanech: Památka světové hondoty na seznam světového dědictví UNESCO* (pp. 89–94). Malovaný kraj Břeclav.
- Hakyung, J. (2013). On the origin of the Glagolitic alphabet. *Scripta*, 5, 105–130.
- Hanuliak, M., & Pieta, K. (2014). 9th century movable material evidence of Christianisation in the eastern parts of Great Moravia. In P. Kouřil (Ed.), *The Cyril and Methodius mission and Europe: 1150 years since the arrival of the Thessaloniki brothers in Great Moravia* (pp. 138–151). Institute of Archaeology of the Academy of Sciences of the Czech Republic.
- Heather, P. J. (2010). *Empires and barbarians: The fall of Rome and the birth of Europe*. Oxford University Press.
- Heintz, C. (2011). Cognitive history and cultural epidemiology. In L. H. Martin, & J. Sørensen (Eds.), *Past minds: Studies in cognitive historiography* (pp. 11–28). Equinox Pub. Ltd.

- Heintz, C., Blancke, S., & Scott-Phillips, T. (2019). Methods for studying cultural attraction. *Evolutionary Anthropology*, 28(1), 18–20. <https://doi.org/10.1002/evan.21764>.
- Hetényi, M., & Ivanič, P. (2021). The contribution of SS. Cyril and Methodius to culture and religion. *Religions*, 12(6), 417.
- Holeščák, M. (2019). *Medieval archery equipment from the territory of Slovakia*. Institute of Archaeology, Slovak Academy of Sciences & VEDA, Publishing House of the Slovak Academy of Sciences.
- Kaizer, J., Wild, E. M., Stadler, P., Teschler-Nicola, M., & Steier, P. (2019). Update on the absolute chronology of the Migration Period in Central Europe (375–568 AD): New data from Maria Ponssee, Lower Austria. *Radiocarbon*, 61(6), 1653–1662. <https://doi.org/10.1017/RDC.2019.89>.
- Kalhous, D. (2012). *Anatomy of a duchy: The political and ecclesiastical structures of early Přemyslid Bohemia*. Brill.
- Kavánová, B. (1995). Knochen- und Geweihindustrie in Mikulčice. In F. Daim, & L. Poláček (Eds.), *Studien zum Burgwall von Mikulčice* (Vol. I, pp. 113–378). Archeologický ústav AV ČR.
- Kouřil, P. (2014). *Great Moravia and the beginnings of Christianity*. Institute of Archaeology of the Academy of Sciences of the Czech Republic.
- Kučera, K. (2014). History and development of the Latin writing system in the Slavic languages / Geschichte und Entwicklung der lateinischen Schrift in den slavischen Sprachen. In G. Karl, B. Tilman, K. Sebastian, & K. Peter (Eds.), *Halbband 2* (pp. 1514–1525). De Gruyter Mouton.
- Kučerovská, T. (1998). Münzfunde aus Mikulčice. In L. Poláček (Ed.), *Studien zum Burgwall von Mikulčice*. Vol. 3 (pp. 151–170).
- Kuna, M. (2012). Intransigent archaeology: An interview with Evžen Neustupný on his life in archaeology. *Archaeological Dialogues*, 19(1), 3–28. <https://doi.org/10.1017/S1380203812000037>.
- Kuna, M., Hajnalová, M., Kovačiková, L., Lisá, L., Novák, J., Bureš, M., Čílek, V., Hošek, J., Kočár, P., Majer, A., Makowiecki, D., Scott Cummings, L., Šůvová, Z., Světlík, I., Vandenberghe, D., Van Nieuland, J., Yost, L., & Zabilská-Kunek, C., M (2013). The Early Medieval site at Roztoky: The evidence of ecofacts / Raně středověký areál v Roztokách z pohledu ekofaktů. *Památky archeologické*, 104, 59–147.
- László, G., & Rácz, I. (1984). *The treasure of Nagyszentmiklós*. Corvina Kiadó.
- Lunt, H. G. (2000). Thoughts, suggestions, and questions about the earliest Slavic writing systems. *Wiener Slavistisches Jahrbuch*, 46, 271–286.
- Macháček, J. (2014). The Byzantine mission and evidence of its activities in Pohansko u Břeclavi. In P. Kouřil (Ed.), *The Cyril and Methodius mission and Europe: 1150 years since the arrival of the Thessaloniki brothers in Great Moravia* (pp. 92–101). Institute of Archaeology of the Academy of Sciences of the Czech Republic.
- Macháček, J. (2019). Svatopluk's three wands: The collapse and regeneration of early mediaeval empires. In M. Bárta, & M. Kovář (Eds.), *Civilisations: Collapse and regeneration. Rise, fall and transformation in history* (pp. 271–314). Academia.
- Macháček, J. (2021). Slave trade in Great Moravia: Reality or fiction? In F. Biermann, & M. Jankowiak (Eds.), *The archaeology of slavery in Early Medieval Northern Europe: The invisible commodity* (pp. 113–126). Springer.
- Macháček, J., Nedoma, R., Dresler, P., Schulz, I., Lagonik, E., Johnson, S. M., Kaňáková, L., Slámová, A., Llamas, B., Wegmann, D., & Hofmanová, Z. (2021). Runes from Lány (Czech Republic): The oldest inscription among slavs. A new standard for multidisciplinary analysis of runic bones. *Journal of Archaeological Science*, 127, 105333. <https://doi.org/10.1016/j.jas.2021.105333>.
- Marcus, J. (2006). Mesoamerica: Scripts. In K. Brown (Ed.), *Encyclopedia of language and linguistics* (2nd Edition) (pp. 16–27). Elsevier.
- Marti, R. (2014). Historical graphemics of the Slavic languages: The Glagolitic and Cyrillic writing systems. In G. Karl, B. Tilman, K. Sebastian, & K. Peter (Eds.), *Halbband 2* (pp. 1497–1513). De Gruyter Mouton.
- Martin, L. H., & Sørensen, J. (2011). *Past minds: Studies in cognitive historiography*. Equinox Pub. Ltd.
- Mathiesen, R. (2014). A new reconstruction of the original Glagolitic alphabet. In M. Flier, D. Birnbaum, & C. Vakareliyska (Eds.), *Philology broad and deep: In Memoriam Horace G. Lunt* (pp. 187–214). Slavica.
- Militký, J. (2020). Finds of ancient coins in medieval and early modern contexts in the Czech Republic and Slovakia. In M. Bogucki (Ed.), *Slivers of antiquity: The use of ancient coins in Central, Eastern and Northern Europe in the medieval and modern periods* (pp. 221–262). University of Warsaw.

- Nash, T. (2021). Cultures of writing: Rethinking the ‘spread’ and ‘development’ of writing systems in the Bronze Age Mediterranean. In P. J. Boyes, P. M. Steele, & N. E. Astoreca (Eds.), *The social and cultural contexts of historic writing practices* (pp. 209–229). Oxbow.
- Nedoma, R. (2003). Runennamen. In H. Beck (Ed.), *Reallexikon der Germanischen Altertumskunde* (Vol. 25, pp. 556–562). de Gruyter.
- Nedoma, R. (2006). Schrift Und Sprache in den südgermanischen Runeninschriften. In A. Bammesberger, & G. Waxenberger (Eds.), *Das fupark und seine einzelsprachlichen Weiterentwicklungen* (pp. 109–156). de Gruyter.
- Neustupný, E. (1993). *Archaeological method*. Cambridge University Press.
- Ohijenko, I. (1964). *Monk Chrabr on Slavic writings: The oldest Cyrillic version of 1348*. University of Manitoba.
- Olalde, I., Carrión, P., Mikić, I., Rohland, N., Mallick, S., Lazaridis, I., Mah, M., Korać, M., Golubović, S., Petković, S., Miladinović-Radmilović, N., Vulović, D., Alihodžić, T., Ash, A., Baeta, M., Bartík, J., Bedić, Ž., Bilić, M., Bonsall, C., & Reich, D. (2023). A genetic history of the Balkans from Roman frontier to Slavic migrations. *Cell*, 186(25), 5472–5485. <https://doi.org/10.1016/j.cell.2023.10.018>
- Overmann, K. A. (2021). A cognitive archaeology of writing: Concepts, models, goals. In P. J. Boyes, P. M. Steele, & N. E. Astoreca (Eds.), *The social and cultural contexts of historic writing practices* (pp. 55–72). Oxbow.
- Parczewski, M. (1991). Origins of early Slav culture in Poland. *Antiquity*, 65(248), 676–683. <https://doi.org/10.1017/S0003598X00080303>
- Parczewski, M. (1997). Beginnings of the Slavs’ culture. In P. Urbańczyk (Ed.), *Origins of Central Europe* (pp. 79–90). Scientific Society of Polish Archaeologists.
- Parczewski, M. (2004). Slavs and the early Slav culture. In P. I. Bogucki, & P. J. Crabtree (Eds.), *Ancient Europe 8000 BC–AD 1000: Encyclopedia of the Barbarian world* (pp. 414–417). Thompson/Gale.
- Pavlović, D. (2017). Začetki Zgodnjėslovanske Poselitve Prekmurja. *Arheološki Vestnik*, 68, 349–386.
- Peltola, S., Majander, K., Makarov, N., Dobrovolskaya, M., Nordqvist, K., Salmela, E., & Onkamo, P. (2023). Genetic admixture and language shift in the medieval Volga–Oka interfluvium. *Current Biology*, 33(1), 174–182e110. <https://doi.org/10.1016/j.cub.2022.11.036>.
- Pieta, K., & Robak, Z. (2017). The early medieval hillfort Bojná — Valy, Slovakia, and its defence system. *Acta Archaeologica Carpathica*, 52, 329–351.
- Pohl, W., Krause, J., Vida, T., & Geary, P. (2021). Integrating genetic, archaeological, and historical perspectives on Eastern Central Europe, 400–900 AD: Brief description of the ERC Synergy Grant – HistoGenes 856453. *Historical Studies on Central Europe*, 1(1), 213–228. <https://doi.org/10.47074/HSCE.2021>.
- Poláček, L. (2008a). Great Moravia, the power centre at Mikulčice and the issue of the socioeconomic structure. In L. Poláček, & P. Velemínský (Eds.), *Anthropological and epidemiological characterization of Great-Moravian population in connection with the social and economic structure* (pp. 11–44). Archeologický ústav AV ČR Brno, vvi.
- Poláček, L. (2008b). Mikulčice und Awaren: Zur Interpretation ‘awarischer’ Funde von Mikulčice. In J. Bemann, & M. Schmauder (Eds.), *Kulturwandel in Mitteleuropa: Langobarden, Awaren, Slawen. Akten der Internationalen Tagung in Bonn Vom 25. Bis 28. Februar 2008* (pp. 579–590). Dr. Rudolf Habelt GmbH.
- Poláček, L. (2014). Mikulčice. In P. Kouřil (Ed.), *Great Moravia and the beginnings of Christianity* (pp. 184–187). Institute of Archaeology of the Academy of Sciences of the Czech Republic.
- Poláček, L., & Marek, O. (2006). *Terénní výzkum v Mikulčicích* (Vol. 1). Archeologický ústav AV ČR.
- Poláček, L., Marek, O., & Skopal, R. (2000). Holzfunde aus Mikulčice. In L. Poláček (Ed.), *Studien zum Burgwall von Mikulčice* (pp. 177–302). Archeologický ústav Akademie věd České republiky.
- Poulik, J. (1975). *Mikulčice: Sídlo a pevnost knížat velkomoravských*. Academia.
- Powell, A., Shennan, S., & Thomas, M. G. (2009). Late pleistocene demography and the appearance of Modern Human behavior. *Science*, 324(5932), 1298–1301. <https://doi.org/10.1126/science.1170165>.
- Pukanec, M. (2020). *The Kiev leaflets as Folia Glagolitica Zempliniensia*. Cambridge Scholars.
- Reimer, P. J., Austin, W. E. N., Bard, E., Bayliss, A., Blackwell, P. G., Ramsey, B., Butzin, C., Cheng, M., Edwards, H., Friedrich, R. L., Grootes, M., Guilderson, P. M., Hajdas, T. P., Heaton, I., Hogg, T. J., Hughen, A. G., Kromer, K. A., Manning, B., Muscheler, S. W., & Talamo, R., S (2020). The Intcal20 Northern Hemisphere radiocarbon age calibration curve (0–55 Cal kbp). *Radiocarbon*, 62(4), 725–757. <https://doi.org/10.1017/Rdc.2020.41>.
- Róna-Tas, A. (1982). Die Inschrift des Nadelbehalters von Szarvas (Ungarn). *Ural-Altäische Jahrbücher N F*, 9, 1–34.

- Šafárik, P. J. (Ed.). (1853). *Památky hlaholského písemnictví*. Tiskem císa. král. dvorské knihtiskárny synův Bohumila Haase.
- Schneeweiß, J. (2020). *Zwischen den Welten: Archäologie einer europäischen Grenzregion Zwischen Sachsen, Slawen, Franken und Dänen*. Wachholtz.
- Scott-Phillips, T., Blancke, S., & Heintz, C. (2018). Four misunderstandings about cultural attraction. *Evolutionary Anthropology*, 27(4), 162–173. <https://doi.org/10.1002/evan.21716>.
- Shennan, S. (2009). Evolutionary demography and the population history of the European Early Neolithic. *Human Biology*, 81(2–3), 339–355. <https://doi.org/10.3378/027.081.0312>
- Sperber, D. (1996). *Explaining culture: A naturalistic approach*. Blackwell.
- Sperber, D., & Hirschfeld, L. (1999). Culture, cognition, and evolution. In R. A. Wilson & F. C. Keil (Eds.), *The MIT encyclopedia of the cognitive sciences* (pp. cxi–cxxxii). MIT Press.
- Szalontai, C., & Károly, L. (2013). Runiform fragments of the late Avar period from Hungary. *Acta Orientalia*, 66(4), 365–396. <https://doi.org/10.1556/aorient.66.2013.4.1>
- Szőke, B. M. (2014). *The carolingian age in the carpathian Basin*. Permanent exhibition of the Hungarian National Museum. Hungarian National Museum.
- Taylor, T. (2008). Prehistory vs. archaeology: Terms of engagement. *Journal of World Prehistory*, 21(1), 1–18. <https://doi.org/10.1007/s10963-008-9011-1>.
- Vančo, M. (2008). The ninth century Great Moravian figural motifs of Orantes. *Starohrvatska Prosvjeta*, 35, 43–61.
- Vavřínek, V. (1963). *Církevní misie v dějinách Velké Moravy*. Nakladatelství Lidové demokracie.
- Vavřínek, V. (2013). *Cyril a Metoděj mezi Konstantinopolí a Římem*. Vyšehrad.
- Večerka, R. (2014). The Kiev fragments and Great Moravia. In P. Kouřil (Ed.), *The Cyril and Methodius mission and Europe: 1150 years since the arrival of the Thessaloniki brothers in Great Moravia* (pp. 262–265). Institute of Archaeology of the Academy of Sciences of the Czech Republic.
- Witmore, C. (2014). Archaeology and the new materialisms. *Journal of Contemporary Archaeology*, 1(2), 203–246.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.