Towards an Indian Ocean and Maritime Asia Slave Trade Database: An Exploration of Concepts, Lessons and Models

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Introduction: Exploring Slave Trade in Asia

1   Over the last three decades, the creation and publication of the *Transatlantic Slave Trade Database* (TASTD) has had a resounding impact on the scholarship of the slave trade and slavery, most notably for the Atlantic world. Using the seminal work of Philip Curtin as starting point, the *TASTD* has completely renovated the reconstruction of slave trade scholarship (Curtin 2010). Where Curtin's research chronicled slave trading activity in centuries or quarter centuries, the *Transatlantic Slave Trade Database* documents slave trading per voyage and provides estimates of slave trade activity annually. Where Curtin's research listed embarkation and disembarkation places as coastal regions or American colonies, the *Transatlantic Slave Trade Database*, where possible, documented places of embarkation and disembarkation on a port-by-port basis. Bringing together data collected by a wide community of scholars and spanning the different colonial empires and regions involved in the Atlantic slave trade, the *Transatlantic Slave Trade*

Database has enabled the generation of new reconstructions and estimates, as well as making new connections, giving impetus to new research, and raising public awareness (Eltis & Richardson 2008: 3-4).

2 Around the same time that the *Transatlantic Slave Trade Database* initiative took off, scholarship started to indicate the widespread presence of slavery and the slave trade throughout maritime Asia from the early modern period well into the 19th century. Part of this interest emerged from studies on the Atlantic, and showed the rise of slave-based plantation economies in the 18th-century western Indian Ocean (Freeman-Grenville 1965; Alpers 1970). This wave of studies also indicated the widespread existence of slavery, the slave trade and slave raiding in the Indonesian archipelago (Reid & Brewster 1983; Warren 1981). Despite this foundational scholarship, estimates for the slave trade in the Indian Ocean are still tentative, and tend to focus especially on the (western) Indian Ocean region.[1] Unlike the Atlantic, these early studies of slavery and slave trade in the Indian Ocean and Indonesian Archipelago regions have not led to large-scale research, reconstructive attempts or data collections. This has led some scholars to suggest that the 'scanty and periodic' evidence for the slave trade in the Indian Ocean 'might reflect the spasmodic and periodic nature of the slave trade but also the sheer lack of information for long stretches of time' (Arasaratnam 1995:195; Finkelman & Miller 1998: 851; Vink 2003).

3 The more recent wave of studies on slavery and the slave trade especially in South and Southeast Asia indicates that this is not necessarily the case for both of these factors. Although perhaps less visible, and thus documented in less overt source material, several studies indicate the sizeable and also structural slave trade through smaller-scale private networks as well as large- scale shipments by European companies and other slavers and slave merchants (Krieger 2017; Machado 2003, 2014; Kanumoyoso 2011; Dijk 2008; Knaap & Sutherland 2004; Arasaratnam 1995; Shell 1994; Mann 2012; van Rossum 2015a and b; Knaap 1995; Vink 2003; Allen 2015; Mbeki & van Rossum 2017). Furthermore, detailed and often widespread sources are available that either document the slave trade directly, administer demographic information on enslaved populations, or provide other relevant information (Kanumoyoso 2011; Mbeki & van Rossum 2017). Bringing together this material, it becomes clear that much more research needs to be done, and that there may be no reason to preemptively assume that the slave trade in (maritime) Asia was much less extensive than its Atlantic counterpart (Vink 2003; Allen 2010, 2014, 2017; van Rossum 2015a and b).

4 In many ways the history of the slave trade in Asia has thus remained underdeveloped, with scholars explicitly voicing the problematic obscuring effects of the lack of 'a comprehensive slaving voyage inventory comparable to the Voyages database' (Allen 2017). Obviously, the politics of memory for Atlantic slavery and maritime Asia slavery differ fundamentally. In the latter case, there is no unifying concept such as the 'Middle Passage' and we are dealing with multiple regimes of slavery and slave trade in Asia. Atlantic slavery has left a legacy and politics of memory that drove the effort to reconstruct the history of the slave trade. Slavery in Asia has never been presented, and may not be presented, as a singular crime against humanity. Yet slavery was widespread in this part of the world and even today coerced labour conditions are far from extinguished. With the database we aim to contribute both to the awareness that Europe was also extensively involved in the Asian slave trade and to the realization that slavery and labour-coercion are universal and persistent phenomena.

5   The present state of the field of slavery and slave trade studies for maritime Asia can be characterized as follows:

    1. It is fragmented. Slavery and related forms of bondage are studied for different regions, but usually not in a comparative frame or with acknowledgement of their interconnectedness (van Rossum 2020a).

    2. It is underdeveloped. Several important studies exist, but remain limited to rough estimates or specific imperial contexts. Recent studies successfully challenged this, but the available ground-data remains relatively limited (Allen 2010, 2015).

    3. It does not yet fully mobilize the wealth of available historical and quantifiable data on slave transportations, enslaved populations, markets and prices (Chatterjee & Eaton 2006; Mbeki & van Rossum 2017; Bosma 2019).

6   It is within this current research context that an international group of researchers has come together to work towards consolidating research on the slave trade in and around the Indian Ocean, with the aim of working towards a global history of slavery. Emerging from a series of workshops in Amsterdam (2016; 2018), Kalmar (2017) and Lyon (2019), the network tries to bring together scholars committed to developing a more integrated field, including East, Southeast and South Asia as well as East Africa, to study the Asian slave trade and slavery studies from comparative, interconnected and global perspectives. Key groundwork in driving both current and future research in the field of Asian slavery studies entails the creation of the basis for a collaborative slave trade database initiative. Within this wider network of Asian slavery and slave trade studies, we have therefore initiated the project *Exploring Slave Trade in Asia* that aims to work towards such a collaborative slave trade database.[2] This project involves the collection and curation of existing datasets, the creation of an initial data infrastructure (pilot), and identifying source material for future data creation.

7   The first stage in the process of this Indian Ocean and Maritime Asia Slave Trade Database project—for which we have chosen the acronym ESTA—is well underway. Important key datasets on the slave trade in Asia have been collected and sustainably stored in a dedicated Indian Ocean and Maritime Asia Slave Trade Databases Dataverse.[3] So far datasets have been gathered and stored on VOC (Dutch East India Company) trade in Asian slaves, European slave trade voyages to and from Madagascar, slave trade transactions in VOC Cochin, slave trade and shipping data concerning Makassar, and collected references to the slave trade in digitized VOC sources. These datasets vary significantly as to the types of data they contain. In tandem with collecting and curating additional datasets, those already collected have been analysed in order to understand both their construction and the possibilities for bringing them together into an overarching Indian Ocean and Maritime Asia slave trade data structure.

8   An international collaboration to bring together existing and new data that provide insight into the interconnected patterns of the slave trade throughout the Indian Ocean, Indonesian Archipelago and East Asia is pivotal to advancing the field, overcoming fragmentation and stimulating new research and estimates. Although the example of the TASTD provides a fruitful model that can and should be used, developing a fitting data structure is not a matter of simply transferring and adopting existing data models. The issue of what data model is required, what its design should look like, and how it can relate to existing datasets such as the important TASTD, is a full and independent research question in itself. This article therefore explores what the design of such a data-infrastructure should look like by analysing 1) the lessons

learned from the experiences of the Trans-Atlantic Slave Trade Database, 2) in relation to the specificities of the Indian Ocean and Indonesian Archipelago sources and patterns of slave trading, and 3) their implications for possible data model designs.[4] The article proposes and evaluates two database models, and closes with conclusions on the advances made and challenges lying ahead.

Beyond the Transatlantic Slave Trade Database: Indian Ocean World Complexities

9   Notwithstanding its monumental importance, two important critiques have been made of the Transatlantic Slave Trade Database that urge future scholars to reflect critically about how to build upon and use its current format for future projects. The first critique stresses the tendency for the lived experiences of the enslaved individuals to become subsumed within more abstract statistics and figures (Rediker 2007: 354). The second questions the ability of quantitative studies to adequately address the 'operational complexity and diversity of the trade' (Miller 1976: 76). In response to this, subsequent scholarship has called for 'detailed analysis' of and further research on 'social transformations' and 'how the advent of Atlantic slavery affected African societies' (Candido 2013: 14; Green 2012: 4-5; Strickrodt 2015: 5). From the TASTD project itself two avenues developed, the first dealing with the intra-American slave trade, and the second with individuals involved in the trans-Atlantic slave trade.[5]

10   Both these critiques ring true—possibly to an even greater extent—for scholars considering methods of capturing data on the slave trade in the context of the Indian Ocean area. The call for more attention to the transforming impact of Atlantic slavery on the exporting African societies is a particularly relevant reminder to scholars of slavery in Asia to address the impact of the entanglement of global long-distance slave trading with local systems of slavery and forced labour, and the complexities of studying the slave trade outside the Atlantic that these entanglements point to. Let us explore here the key specifics of the Indian Ocean and Indonesian areas that are crucial to consider with regard to an attempt to design an overarching Indian Ocean and Maritime Asia slave trade data structure.

Connectedness and multi-directionality

11   The long-distance slave trade across the Indian Ocean basin emerged and operated within and as part of a myriad of established connections and exchanges. Inspired by *Annaliste* geo-historical conceptualizations of peoples in relation to oceans, attention has been given to the seasonal monsoon winds enabling sailors of different nationalities to connect the various coastlines of the Indian Ocean- routes which can be traced back to 300BC (Vink 2003: 137-8). K. N. Chaudhuri has outlined four forces of human expansion in the Indian Ocean basin, all of which involved the movement of people, and the means of travel, economic and cultural exchange, and which, according to Chaudhuri, created elements of cohesion across the basin; of these forces, European maritime expansion constitutes only the fourth and final cycle (Chaudhuri 1985). Janet Abu-Lughod has built on the work of Chaudhuri, defining the Indian Ocean as 'that great highway for the migration of peoples, for cultural diffusion, and for economic exchange' (Abu-Lughod 2013). Large-scale migrations thus typified lived human

experience across this vast geographic region as competing political and religious regimes rose and subsided.

12   The slave trade and coerced mobilities played an important role in connecting the different parts of the Indian Ocean and Indonesian Archipelago regions. Much more than in the Atlantic, this long-distance slave trade was *multi-directional* and consisted of many middle passages, both through large-scale shipments of enslaved human beings and continuous and consistent flows of smaller, even individual displacements. The forced relocation of people stood in part in relation to the cycles of natural and human-induced disasters; work has been done to show the direct correlation between wars and famines and the numbers of enslaved persons available for purchase and displacement. Illustrative of these trends are: the 3,859 individuals imported into Ceylon from the Coromandel coast in the 1694-6 period of war in South India; the export by the VOC of 2,118 slaves to Batavia from the Coromandel in 1646 alone in response to a famine; and the mass exportations from Sulawesi after the collapse of the sultanate of Makassar (Vink 2003: 142-3). The emergence of slave societies stood in clear conversation with these cross-oceanic cycles of connection and interaction. Ross Dunn has argued that the slave societies dispersed throughout the Indian Ocean basin did not merely interact with each other, but together made up a 'world of slaves' in which the 'slave societies' existed as interacting elements of the overarching whole, rather than of separate 'worlds' of slaves in relation to each other (Vink 2003: 138).

Beyond plantation slavery

13   Where previous scholarship constructed a dichotomy between Asian household slavery and Atlantic plantation slavery, arguing for a 'milder' characterization of Asian slavery based on the pervasiveness of status- and debt-based household slavery, more recent scholarship has, working from this framework of connection, stressed that slavery in Asia formed a 'dynamic of a continuously adapting, globally connected and increasingly capitalist economic system' (Reid & Brewster 1983; Mann 2012: 22). It points to the prevalence of slave markets and slavery in economic production areas, emphasizing the 'chattel'-based nature of the slavery system which functioned as the foundation for coerced labour units across agricultural and transport development, as well as the intensive plantation production in areas such as the Banda Islands in the Indonesian archipelago (Worden 1985; Biewenga 1999; van Zanden 1991; Winn 2010). Much of the focus of the histories of slavery on the Atlantic slave trade can be attributed to the centrality of plantation slavery to these analyses. From this Atlantic-centric understanding of slavery, analysis beyond the Atlantic Ocean naturally extended firstly to the Cape of Good Hope and its links with transporting enslaved people to supply plantation slavery on the Swahili coast and on the Mascarene Islands. By contrast, Asian colonial historiography has tended to distinguish plantation slavery from 'new systems of slavery', centering on the position of indentured and coerced labourers. In an attempt to bring these different manifestations of forced labour together, Markus Vink argued that 'despite the problematic nature of the term "slave" in an Indian Ocean context, its special characteristics included property or chattel status and the ensuing potential of re-isolation, institutionalized coercion and systemic exploitation, outsider status or essential kinlessness, defined as "social death", and lack of control over physical reproduction and sexuality'(Vink 2003: 196). Recent scholarship on slave labour throughout the VOC empire has stressed the simultaneous existence and

reliance on multiple manifestations of slavery; the Banda Islands depended almost entirely on the work of slaves, whereas the *corvée* supplied Ceylon with the large majority of labour required to sustain the agricultural production of cinnamon and areca nuts (Mbeki & van Rossum 2017).

14   Long-distance slave trade, undertaken by both Asian and European merchants, thus played a crucial role in establishing, reinforcing and even transforming connections between slave societies in the Indian Ocean basin (van Rossum 2020a). With European expansion in early modern Asia came an increased demand for the forced labour necessary to supply it. In many cases, such as in the *corvée* systems in Ceylon, colonial expansion met with and adapted local forms of bondage and slavery to meet its own commercial needs. In other cases, such as in the mass deportation of people from along the Coromandel coast, either the need to directly supply slave labour to other colonies, or the opportunities to make a profit in supplying the colony with its labour needs, intensified the connections between early modern Asian slave societies, bringing regions long associated with debt-, war- or status-based forms of slavery into direct contact with commodified forms of slavery and global expansion. The coexistence of both commodified and *corvée* and tribute forms of bondage, as well as the transformational impact of the commodified long-distance slave trade, reduces the utility of distinctions between types of slavery, thus underscoring the need to work towards a global history of slavery through a database which brings its multiple manifestations together whilst simultaneously retaining the ability for scholars to ascribe certain layers of temporal, geographic and economic characteristics and context to the data.

Beyond Company trade

15   These entanglements not only concerned the origins and destinations of the enslaved, and the impact of long-distance slave trading on connecting local slave societies into a global 'world of slaves', to use Dunn's terminology, but also drew slave trading agents into an increasingly connected world of trade and profit. The interplay of commission and opportunism is clearly demonstrated in the pervasiveness of private auxiliary trading activities throughout the company structures of the VOC. According to E.M. Jacobs the role of the VOC in the Indian Ocean slave trade was minimal. Jacobs cites the lack of a significant contribution by the slave trade to the VOC's wealth—half a percent of the total worth of the VOC's trade in the 18th century—as proof (Jacobs 2000: 277; van Rossum 2015b: 44). More recent scholarship has however proven that we should move beyond this type of reasoning. Instead, it has been demonstrated that commissioned VOC voyages offered an attractive opportunity for personnel to engage in private slave trade, making use of the trade routes throughout maritime Asia to turn an immediate profit. In fact, this phenomenon seems to have been such a central feature of (VOC) European slave trade, that complaints about 'vervloekte goudzugt' (cursed greed) among the company officials were included in the reports from the VOC empire back to the Dutch Republic (van Rossum 2015b). A well-known example of the intimate interactions of these various actors is that of the Dutch VOC-official Jacob Bickes Bakker who, in conjunction with his work for the VOC in Makassar, sent his private ship 'De Hoop' to trade in slaves under the command of a citizen from Makassar (Knaap & Sutherland 2004; van Rossum 2015b: 45-6). Private activities such as those of Bakker were not simply opportunistic *ad hoc* activities subject to external 'famine-slave'

cycles, but appear to have formed a structural component of the slave trade in maritime Asia. The evidence points to the prevalence of private slave trading throughout the ranks of the VOC; it was not only high-ranking officials, but also officers, bookkeepers, surgeons and mid-ranking officials who used their journeys on board VOC ships to privately buy and sell slaves for private profit (van Rossum 2015a). This private slave trade held crucial importance for other European empires such as the French and Danish (Thiébaut 2017; Krieger 2012).

Beyond official port records

16   Unravelling some of these micro-level entanglements helps go some way towards answering the questions that remain when we focus too heavily on macro-level analysis of the slave trade in early modern Asia, especially in light of noticeable absences in the source material available at this level. The extensive scholarship on the slave trade around Madagascar and the Mascarene Islands demonstrates that official records are not adequately representative of the full range of slave trading structures across the Indian Ocean. Here we encounter a key contrast with much of the source material on Atlantic slave trade. The wealth of source material documenting the transatlantic slave trade is mostly compiled from port documents (including logs, records of duties), insurance papers and newspapers; these documents all detail the movement of ships, making a database structured along similar lines the obvious choice for capturing the data contained in such sources. For Mauritius, Richard Allen has shown the problematic nature of the *déclarations d'arrivée* held in the Mauritius National Archives: they are only available for a period of 38 years (1772-1810), and many contain only scanty information about the origin, size, or composition of the human cargoes (Allen 2017). Historians are therefore quickly pushed to look beyond official port records when seeking to quantify circuits and flows of the slave trade to and from Mauritius.

17   The benefits of bringing different levels of analysis (as well as source availability) together is evident in recent scholarship. Bringing together population statistics available across Asia, Markus Vink came to the conclusion that 66,348 slaves were in the possession of the VOC in the year 1688; from this Vink estimated that a total of between 4,476 to 7,716 slaves needed to be supplied to the VOC colonies annually in order to reach these population levels (Vink 2003: 166). Work on population increases in slave societies like Batavia and the Banda Islands demonstrated the subsequent exponential growth of slave populations in VOC-controlled territories well into the late 18th century. The number of slaves in Batavia grew from roughly 26,000 in 1688 to 40,000 by 1779; in the Banda Islands the 2,200 slaves working the nutmeg plantations in 1638 rose to 3,700 in 1688 and peaked at 4,100 in 1794 (van Rossum 2015b: 39). Supplementing Vink's methods of calculating the demand for slaves across the VOC colonies with these population statistics resulted in an estimate of at least 660,000 and up to 1,135,000 slaves supplied to VOC colonies throughout the period of the VOC's presence in Asia (van Rossum 2015b: 41). These estimates, derived from population statistics and extrapolations, indicate clear gaps in source material when compared with reconstructions based purely on voyage-based sources. Estimates of VOC slave trade by Richard Allen, based on a reconstruction of slave trading routes and ships, results in an estimated 32,465 to 43,465 slaves transported by VOC ships (Allen 2010: 62-4). When these estimates are combined with numbers taken from the *Boekhouder Generaal Batavia* database, new estimates emerge of 37,854 to 53,544 slaves transported

by the VOC between destinations in Asia in the 17th and 18th centuries (van Rossum 2015b: 43). These discrepancies between the reconstructions based on slave populations and voyage-based sources are significant, and clearly illustrate the need to approach reconstructions of the slave trade in early modern Asia from multiple perspectives. By bringing in population statistics and reconstructions, gaps in the source material become evident; it is in further disentangling micro-level details, such as the highly individualized interactions between private and company trade, that these discrepancies can prompt the pursuit of a more nuanced understanding of slave trade systems and societies in early modern Asia.

18   In bringing together three different levels, namely: a reconstruction of the number of slaves traded according to the sources; estimates (of slaves onboard) based on the extrapolations of known slave trade voyages and trade routes; and estimates based on population figures and the numbers of slaves needed to maintain those figures, it has been possible to show that earlier estimates for the slave trade to the Dutch East India Company empire by Rik van Welie, Markus Vink and Richard Allen have likely been too cautious (van Rossum 2015b: 33). Extending these methods of analysis beyond the activities of the VOC, with the support of an extensive Indian Ocean Maritime Asia Slave Trade database thus seems extremely promising, especially in light of the lack of any certifiable 'dark number' for slave trade in Asia.

Towards a model Indian Ocean Maritime Asia Slave Trade Database

19   How best, then, to design a database that captures the complex details of the *multidirectional* and *interconnected* nature of slave trading in early modern Asia? As outlined above, the implications of existing scholarship on the circuits and patterns of slave trade in the Indian Ocean and Indonesian Archipelago regions have important consequences that challenge us to move beyond the reconstruction of single long-distance (confirmed) maritime voyages. These implications call into question both the object of observation and the method of observation.

20   First, it is clear that a database that focuses only on recording confirmed details on slave trading voyages is likely to underestimate the slave trade and provide too limited a perspective. This will do a disservice to both the complexities and promising details that emerge when various source types are brought into conversation with each other. It is worth considering how to include insights into the interplay of national and private trade as well as insights into the interplay of regional and colonial systems of supply and demand. Bringing together the quantitative data contained in slave population census data, price flows, voyage details, itineraries and outcomes, with the qualitative data contained in individual deeds of transaction, export permissions and even court cases where resistance and *marronage* are detailed, not only enables researchers to analyse the connections between colonial and regional economies or the trends in long-distance shipping patterns, but also to analyse comparatively the full extent of entanglement between global systems of slavery and local forms of bondage. Precisely because the data on the multi-directionality of the slave trade in the Indian Ocean Maritime Asia world is most illuminating when this varying primary source material is brought together, we are challenged to develop a structure that can capture and combine the data in its different available forms.

21 Second, it is clear that for the Indian Ocean and Indonesian Archipelago regions slave trade voyages were not marked by a single, one-directional middle passage, but that the slave trade in these regions was characterized by many middle passages that crossed, overlapped and sometimes juxtaposed each other. This multi-directionality has far-reaching implications for the use of a 'voyage' as a unit of analysis. The TASTD uses the voyage from the African continent to the Americas as the core unit for the database, but it is not evident how this should be transplanted, understood and defined in the context of a multi-directional slave trade. Should a voyage be defined as anything that transfers enslaved humans from coast to coast? Apart from questions as to how to define or delimit a region or coast, this also leaves us with questions as to what to do with coastal slave trade. Should a voyage be defined as any movement from a port to a port? If so, then how to deal with the patterns that occur through longer voyages as characterized by the sum or series of stops in multiple ports? A pivotal part of the problem posed by the issue of multi-directional, long-lasting voyages with different patterns of large-scale corporate slave trading alongside the 'trickling' individual or private activity in the slave trade is indicated by the fact that the TASTD relies heavily not only on the clear one-directionality voyage structure, but also on the ship's voyage as a core unit of analysis. How to move beyond this structure centered on single voyages of ships with human cargoes, with a limited number of possible places of embarkation and disembarkation?

22 Third, the debates on slavery and the slave trade in the Indian Ocean and Indonesian Archipelago regions make clear that besides the widespread commodified slavery and the slave trade fuelled by this, there existed other different forms of non-commodified slavery, as well as other forms of non-commodified and commodified coerced mobility —think, for example, of large-scale deportation of groups of people after conquest, such as the people of Ciauw coercively captured and deported by the Dutch in 1615, but also of the transplantation of bondsmen or *pandelingen* (debt slaves), or of the (coercive) migration circuits of contract labourers, which expanded rapidly especially in the 19th and 20th centuries (van Rossum 2020b). In contrast to the Atlantic context, it is much less evident that every (coerced) movement of people across Indian Ocean or Indonesian Archipelago involved slave trading in the sense of enslaved human beings transferred in commodified and legalized circuits of slavery. To improve our understanding of these patterns of slave trading, and their existence side by side, and interaction with other forms of coerced relocation (as well as the many wider labour or slavery regimes that these related to), it is important to provide for a nuanced structure to record observations in a way that creates more depth and substance, rather than to merge everything into one single category of slave trading or coerced mobility.

23 As a basis for designing a database that allows us to capture the various manifestations of the slave trade in the Indian Ocean and Indonesian Archipelago that emerge from the multiple and varied types of observations available for this part of the world, it is thus crucial to distinguish between the different levels through which we can approach the slave trade, and for which historical information is available. When we consider the popularity of the atlas feature of the Transatlantic Slave Trade Database that enables users to visualize and trace slave trade voyages across the Atlantic, it seems to make most sense to develop a structure that focuses on a level compatible to (the meso-level of) the TASTD. Yet at the same time, it is crucial to create a structure that retains

sufficient flexibility to record data across, as well as differentiate between, the different levels of analysis. Basically, the slave trade can be approached through three distinct levels that reflect both the level on which we can capture historical reality and the level on which historical data in different degree of detail is available:

1. On the *macro level* patterns of slave trade are best captured by the *flows* of slave trading, often provided by aggregated data or estimates (contemporary or later) on slave trade routes, or by indications provided through estimate-based (demographic) data on enslaved populations.

2. On the *meso level* most data concerns slave-trading voyages. Here the data can either concern the ship and its voyages, or the coerced mobility of specific groups of people.

3. On the *micro level* there is—especially for specific parts of the Indian Ocean and Indonesian Archipelago—slave trading data recorded on the level of *individual transactions.*

24   The database structure not only needs to optimize the combination of these three levels, but also needs to ensure its compatibility with four main different types of source material on which current datasets are based, and that are especially crucial for further future data creation. These four types are:

1. Sources directly documenting slave trading:
   – Voyage-structured sources—especially European and non-European merchant records, providing voyage observations (ships' logs; merchant account books);
   – Otherwise-structured sources, often location or port-centered—especially serial European colonial government/Company records (slave trade registers, often recording individual transactions).

1. Sources indirectly documenting slave trading (tax registers)—also often location or port-centered, and in that sense often connected or similar to slave trading registers (1b). Both the tax and slave trading registers make up *partial* voyage observations, providing information on arrival or departure (in themselves, or in combination with other sources).

2. Sources that do not document slave trading, but make it traceable through (or by combining them with) other sources and observations (shipping data, e.g. combining them with slave or tax registers; population data, e.g. as a basis for slave trading/import estimates).

3. Sources that document incidental data and indications of (instances of) (criminalized) slave trading, mostly coming to light through problematization (court cases, incidents, reports)—this data can provide contextualization of other available data, as well as indications and even the basis for estimates of patterns and routes that remain outside the scope of other source material.

25   Conceptualizing a database that can effectively address the challenges outlined above should hopefully go a long way towards developing an Indian Ocean slave trade historiography that: supplements quantitative reconstructions and estimates with qualitative analyses of the dynamics and impact of the slave trade; maintains the relationships and connections between the meso-level voyages data and the micro-level data on individual lived experiences; and contributes towards a global history of slavery that stimulates further research into under-studied regions, whilst maintaining compatibility, and thus comparability, with the data collected on Atlantic slavery thus far.

Exploring Alternative Data Structures

26   The key question, however, remains how to design a data structure that meets these requirements and addresses the challenges set out by the context of the Indian Ocean and Indonesian Archipelago regions. The remainder of this article will therefore be devoted to outlining two database models: a relational database model (two different variations); and a graph database model. The principles of these models, initial tests, and challenges are discussed below.

Database Type 1: Relational Models for *Sub-voyages* and *Forced Relations*

27   The primary organizing unit of both the Trans-Atlantic Slave Trade Database and the Intra-American Slave Trade Database is the shipment, defined as 'a single maritime journey of one vessel.'[6] Structuring the Indian Ocean Maritime Asia Slave Trade database around slave trading voyages as the main unit of analysis, would therefore most closely resemble the Transatlantic Slave Trade Database. However, explicitly adopting the basic structure of the Transatlantic Slave Trade database does not adequately allow for the complexities of slave trading in the Indian Ocean area, as outlined above, to be mapped.

28   Even across the datasets already gathered, which are based primarily on a large collection of ships' journals and therefore especially suited to a voyage-oriented database structure, there are significant variations on the level of detail contained in each entry. For many voyage entries, the record is somewhat scanty, containing only a point of departure, a port of call and a port of arrival; entries such as these are clearly well suited to a voyage-based structure modelled on the Transatlantic database. Others, such as the journey of the *Phélypeaux*, which departed Port Louis between the 11th and 13th April 1756, are much more complex and simply cannot be subsumed into a triangular three-embarkation-ports and three-disembarkation-ports structure. The *Phélypeaux*'s voyage took it from Port Louis to St Denis and on to Fort Dauphin, St. Augustin, Tuléar, Monronadace, Rapanda, the Comores, Ste. Marie and finally Foulpointe, before it was wrecked on the 23rd February 1757. Somewhere along this journey, or perhaps at multiple stops along the way, 335-337 enslaved people were picked up and transported (Thiébaut 2018). Almost forty years later, the *Bellonne* set sail from Port Nord-Ouest on a journey of eight months, during which it landed in Fort Dauphin, Ste. Luce, Foulpointe, Ste. Marie, Port Choiseul, Fort Dauphin (again) and Ste. Luce (again). The challenges in mapping these 'voyages', covering many months and often doubling back on themselves, are immediately at odds with the triangular nature of the Transatlantic slave trade.

29   One possible solution is to adapt the Transatlantic Slave Trade database model to better suit the needs of tracking voyages with multiple port stops by organizing the data into a relational database. In a relational data model, the data collected is organized, stored and presented as a series of separate entities, each held in separate tables, connected by relations. Within the tables the data is structured in rows and columns; a row represents a unique instance of that entity type, while columns denote the attributes attached to that instance. Relations between the tables are constructed by assigning each row a unique identifier; columns are then added for the unique identifiers of the

linked rows in other tables. The different tables can be used to organize the different levels of detail available for each forced relocation of enslaved people; by thinking of longer multidirectional journeys, such as the examples of the *Phélypeaux* and the *Bellonne* above, in terms of multiple related 'sub-voyages', or phases of one overarching voyage, voyage entries with multiple stops and dates can be reconciled with voyage entries where only one or two stops are documented. In this way there is no need to make a choice between either losing the broader clarity of an overarching voyage structure, or having to reduce the level of detail available for many of the voyages by reconciling all the entries in a Transatlantic-Slave-Trade-derived data model much better suited to a triangular trade movement. The overarching structure of such a database model has been visualized in Appendix A (illustration 1).

30 Considering the complexity and multidirectional nature of trade voyages undertaken throughout the Indian Ocean, the allocation of the 'sub-voyage' as the main unit of analysis offers a way in which to resolve some of the definition challenges that historians of movement in the Indian Ocean region face. These challenges include questions of how to define an Indian Ocean Maritime Asia 'voyage': at what point do multiple stops on a journey of over a year no longer constitute stages of one 'voyage', but actually smaller separate voyages? By classifying these longer chains of related movement in smaller 'sub-voyages', this model simultaneously allows for the retention of data on the back and forth movement between ports, whilst also providing a structure in which the overarching 'voyage' emerging from these components is clearly recorded and easily analysed. By creating a structure in which a layer of interpretative difference between 'voyage' and 'sub-voyage' can be included, the possibility of direct comparison with voyages held in the Transatlantic Slave Trade Database is maintained, whilst simultaneously recognizing the need for the multidirectional characteristics of slave trading voyages across the Indian Ocean to be considered and recorded.

31 At the same time, a relational database structured in terms of 'sub-voyages' relies on a level of detail across the source material that cannot always be assumed to be present in the data. Where reconstructing the precise movement of slave trading ships formed a crucial part in TASTD's ability to formulate estimates, reconstructing the multidirectional nature of Indian Ocean voyages does not necessarily assist in reconstructing the numbers of enslaved people transported on board those voyages. Given this, a conceptual reorientation away from understanding the slave trade in the Indian Ocean as related mainly to slave trading 'voyages,' and towards understanding the slave trade in the Indian Ocean as various forms of 'forced relocations' (see Appendix B, illustration 2) might be a fruitful way forward.

32 Reorienting the terminology of the database away from voyages and towards forced displacement enables us to return to the three different levels on which source material is currently available, therefore also taking the regional intricacies and varying manifestations of slave trading into account, especially in contexts such as that of Chinese manifestations of bonded labour where slave trading along interior routes played a key role without necessarily including the transportation of enslaved people over water. Reorienting the database towards 'forced relocations' rather than slave trading 'voyages' would enable us to include data entries that hold only information on a large group of people forcibly relocated from an origin to a destination, perhaps even over the space of a number of years. This type of source material seems to typify available sources on overland slave trading routes in China and represents some of the

most abstract, though nonetheless precious, data. Of course, relating database tables that record specific population flows to individual journeys that made up part of those population flows, is also possible in the previous model. Whether this is then just a question of semantics is perhaps a relevant question to ask. However, emphasizing the forced dislocation of enslaved people over the journey of the ship, with the embarkation and disembarkation of enslaved people noted as part of that journey, goes some way to redress the concerns noted by Borucki and O'Malley in the Intra-America Slaving Voyages Database methodology essay, in which the user is reminded that 'the sources that make such quantitative analysis possible are dehumanizing, tallying people in ledgers as trade goods alongside barrels of sugar and crates of textiles.'[7]

33   The main advantage of this reorientation is that the issues with breaking down cumulative totals of slaves embarked and disembarked per stop are largely resolved by keeping the group as a single homogenous one, and not requiring additional research that returns to the sources to piece together the precise breakdown of slave totals for each port stop. At the same time, this is a limitation because it means making an inference about the place of slave embarkation. In subsequent trial models however, variables can be added to include notes indicating uncertainties about points of embarkation/disembarkation, or to note the additional embarkation of more slaves. In this way, different levels of certainty and uncertainty around precise numbers and points of embarkation/disembarkation can be managed without splintering the information across a number of separate sub-voyage entries.

Testing the relational database models

34   The challenges of integrating data into either of these highly structured database models become clear when tested against some of the more complex data in the pilot test batch (see Appendix C, illustrations 3 & 4). Neither variation of a relational Indian Ocean Maritime Asia Slave Trade database outlined above adequately addresses the issue of bringing overlapping entries together. In using two overlapping sample voyages to test both variations, both voyages have been recorded as separate entries, despite the clear overlaps. The intermediate solution to the question of duplicates, in trialling the entry of these two voyages into draft database structures of both variants of the relational database, has been to include a variable in which the unique identifier of another vessel or sub-voyage can be input to indicate possible overlap. This can be extended in subsequent trial models to add a qualifying variable to the overlap variable; with this qualifying variable we can indicate, and define, degrees to which the overlap is likely (certain, likely, possible etc.). While this does make sure that potential duplicates can be tracked and retraced for a later stage of data curation, it does for the present leave open the question of how to deal with duplicate or conflicting information in these highly-structured data models.

Database Type 2: Graph or Observations-based Model

35   Another significant consideration is that work on the pilot database is currently based on the comparison of two key datasets. This is an important and promising place to start as it has allowed us to identify possible issues in designing the database structure, and, on a more detailed level, in bringing overlapping voyages together into one structure. However, we also need to consider the wider body of sources that will feed

the final database. An observation-based database model (more commonly known as a graph database), the second type of database model on which the database could be built, would go some way towards addressing these concerns of ensuring that the eventual database remains adaptable and flexible enough to accommodate new sources, while also answering new and changing research agendas.

36   In a graph database model, the data stored in the tables of a relational database, and therefore structured according to formally described relations, are broken down into the lowest aggregation of data possible. Where the intersection of a row and column (expressed in Excel as a location, eg cell F6) in a relational database contains a single observation about one attribute of one instance of one type of entity, this is subsumed into an overarching entry, in which multiple observations on the various attributes of the instance of the entity are combined. Graph databases by contrast uncouple these various observations contained in formally described rows into multiple single observations that make up a collection of nodes and edges. Where nodes represent an observation, edges signify the relationship between pairs of nodes. In a graph database both the nodes and the edges are given unique identifiers, and each unique identifier has a set of properties attached to it, describing either the properties of the observation or the properties of the relationship between two observations. In this way, the data is structured in its lowest aggregation possible; this ensures the flexibility and reusability of the data for future research since the separate observations can be linked in multiple structures to support changing research agendas.

37   In terms of how a graph database offers a promising structure for an Indian Ocean Maritime Asia Slave Trade database, it is worth considering the different observations as being like different lenses through which to interrogate the data. Rather than flattening or subsuming sources into single entries, a graph database does not try to impose structural or factual rigour onto a body of diverse sources. Instead, all relevant event, individual, vessel, company, population, transaction data can be brought into interaction together, with the database user ultimately able to query the observations according to their own line of research. In this way the database can maintain and accumulate the multiple perspectives on the same events which can often be inconsistent but are not necessarily in conflict (see Appendix D, illustration 5).

38   The challenge with this approach is visualizing the end result for the database user without queries of the database leading to long lists of observations related to a particular attribute (such as a unique vessel or captain name) or a particular geographic location, without the user being able to gain the oversight needed to interpret the results. The links in illustration 5 are a simplistic representation of the web of links a graph-based Indian Ocean Maritime Asia Slave Trade database would incorporate. The observations linked in individual pairs on captain, vessel and group attributes would actually need to be linked to each of the observations related to them:
– VESS1, CAP1, SLAVES1 would all need to be linked to OBS1, OBS2, OBS3,
– VESS2, CAP2, SLAVES2 would all need to be linked to OBS4, OBS5, OBS6, OBS7.

39   The complicated web of links that need to be entered also raises questions about how to indicate overlapping 'voyages'; will it be sufficient to link only the starting points of both voyages, or will each observation belonging to an overarching journey need to be linked to each observation belonging to the overarching overlapping journey? The conflicting information in these entries on the geographic location of each observation

further complicates the question of how these many links will retain any clarity of interpretation for the end user.

Concluding discussion

40   This article explores the need for and complexities of designing a data-infrastructure for the Indian Ocean and Indonesian Archipelago slave trade, suited to the specificities of this context and the lessons learned from the experiences of the Trans-Atlantic Slave Trade Database. The solutions for adapting and designing a database model, as this article indicates, are not evident, but require us to deal with this matter as research questions in themselves. A vital aim in the construction of a comprehensive Indian Ocean and Indonesian Archipelago database involves recording and reconstructing the slave trade, especially in light of entanglements of global long-distance slave trading with local systems of slavery and forced labour. Several challenges have been identified in the exploration of the historical and historiographical context.

41   First, the nature of the field in its present form is still fairly fragmented, with studies on different areas or regions having been insufficiently connected, and with a perhaps insufficiently developed comparative and systematic framework to advance the study of slavery and the slave trade to inform the data creation needed to advance a collective larger database or reconstruction of the slave trade. Despite several important studies, the field remains somewhat underdeveloped, with studies often limiting themselves to specific imperial contexts, regions or time frames. The challenge remains to extract and collect comparative data more systematically, and to identify future source material for more structural data collection on the Indian Ocean and Indonesian Archipelago slave trade.

42   Second, since source material directly documenting slave trading voyages in the Indian Ocean and Indonesian Archipelago regions seem to be more limited and fragmented than the source material available for the Atlantic, and with the availability of official port records varying significantly between regions, more importance should perhaps be given to other types of sources, in turn complicating the data structures required to bring together data from different levels (macro, meso, micro) and types of sources (direct, indirect, complementary, incidental). Supplementary historical and quantifiable data on slave transportations, enslaved populations, markets and prices offer a rich basis for future research; developing a database structure that captures these various types of sources whilst maintaining clarity and distinctions between them remains a challenge.

43   Third, the slave trading journeys and forced relocations in the Indian Ocean and Indonesian Archipelago regions involved a number of origins and destinations, often linked together in chains of multidirectional movement that connected inland slave trading systems with long-distance slave trade shipping; as such any definitions of 'voyages' and 'sub-voyages' within an Indian Ocean Maritime Asia Slave Trade Database will need to retain sufficient flexibility to incorporate the varying manifestations of forced relocations in early modern Asia. For the Transatlantic Slave Trade Database, the common unit of comparison is the shipment, defined as 'a single maritime journey of one vessel'; as this paper has demonstrated, the complexities surrounding Indian Ocean slave trading 'journeys' necessitate further research into the interaction of these slave trading systems in the mobilization of forced labourers, as well as the need to

critically consider how to record these movements and interactions. This implies that the data model should account for the question of how to define a 'voyage' and how to break this down into, and relate it to, 'sub-voyages', while at the same time accounting for the significant variations in the level of detail contained in source material and currently existing datasets.

44   Fourth, the slave trade and forced relocations in the Indian Ocean and Indonesian Archipelago regions involved a variety of agents: European trade companies; private individuals using company ships; non-European slave traders, both maritime and inland. The database will need to categorize and assign roles to the different actors within the slave trade in Asia, whilst recognizing that these categories cannot be absolute. This requires the database structure to be sensitive to both long-distance slave trading voyages and to inland or interior forced relocations; and to larger scale transports of groups of enslaved people as well as (flows of) smaller scale slave trading by individuals.

45   Fifth, the prevalence of conflicting or duplicate data in the comparison between these two key datasets gives a first glimpse into the diverse nature of future source material that will be fed into the database. The multiplicity of data and (different vernacular and imperial) source-sets that needs to be utilized to advance the creation of a collective Indian Ocean and Indonesian Archipelago slave trade database raises the question of how to handle conflicting data observations and especially duplications. In addition to thorough documentation illuminating the database creators' choices, it might be important to develop an accompanying set of prescriptive 'best practices' (including assessing and comparing reliability of conflicting source information) or a way of tracking and indicating possible duplicates and conflicts.

46   These challenges and complexities call for the creation of a clear yet flexible data structure. Issues such as how to define a maritime 'voyage' will need simultaneously to allow room to reflect the interpretations, complexities and ambiguities of the source material, whilst also maintaining a clear and usable database structure for researchers. In this article, we explore two possible models for such a data structure. Where does this leave us?

47   Both data structures have advantages and limitations. The graph (or linked data) model leads to the most flexible way of organizing the data, both current (from existing datasets) and future (from so far unused source material). The flexibility of this graph model, however, at the same time seems to suggest its weakness. As the graph model structures observations in their lowest aggregation, it uncouples (parts of serial) observations from the contextual and guiding structure of the source material. This provides the flexibility of the model and the possibility of more easily creating new links. As the historical entities are not always defined or identified, and the source or data structures themselves often provide context and interpretation, this necessary fragmentation runs the risk of losing layers of implicit knowledge provided by the sources and their structures. In addition, it is crucial to remember that the observations from different source materials, and thus different streams of data, are informed by their specific historical context—ranging from the scope of the information recorded or omitted, to the type of historical object, entity or act recorded, as well as the geospatial labels used. In the smallest form in which observations can be recorded (triples) these links and contexts are lost. This implies the need to classify types of observations and to include more contextual information. These categorized

and extended observations, in turn, however, lead to much more complex designs for the observations and their links that basically resemble relational data structures.

48   One of the main advantages of designing the database along the relational model would be that the database can maintain much more of the original context of the observations from the current data sets or future source material, while more directly serving the immediate research questions of academics currently researching the forced movement of people across the Indian Ocean and Indonesian Archipelago regions and their interaction with local systems of bondage. The possibilities for comparison across colonial powers, local and global systems of slavery, across more widely ranging and strongly defined 'regions' within the Indian Ocean Maritime Asia area, and even with the Transatlantic slave trade, are immediately clear. Compatibility with TASTD is a significant consideration for the IOMASTD project, as is the importance of keeping confirmed and recorded movements together, as recorded in the primary source material.

49   In the methodology essay accompanying the online version of TASTD, Eltis and Richardson write that 'new material tends to raise the question of the appropriateness of the variables used.'[8] Just as the creation and updating of the Transatlantic Slave Trade Database entailed a detailed research process that spanned a significant period, so too will the creation of an Indian Ocean Maritime Asia Slave Trade Database entail multiple stages of designing, testing, assessing, adapting and re-testing. One interesting and potentially fruitful next step will be to compare the current voyage-centered datasets used for the initial stages of the pilot development with both the individual-centered datasets, looking for crossover between voyages and individuals and what possibilities and challenges this might bring to combine available information. Various source materials and datasets are available, but more contributions are welcome. Another crucial step is to discuss these alternative data structures with a larger research community. This article is intended to serve as a catalyst for both steps forward, and to encourage everyone interested to collaborate in the collection, creation and storage of new data, as well as to contribute to the discussion on the design of the structure for a collective Indian Ocean Maritime Asia slave trade database.

Appendix

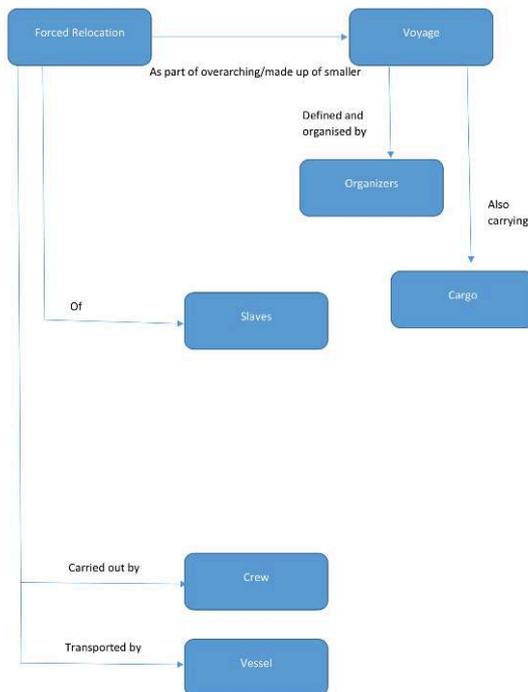## A. A 'Sub-voyage' relational database model:

Illustration 1. Sub-voyage Structure
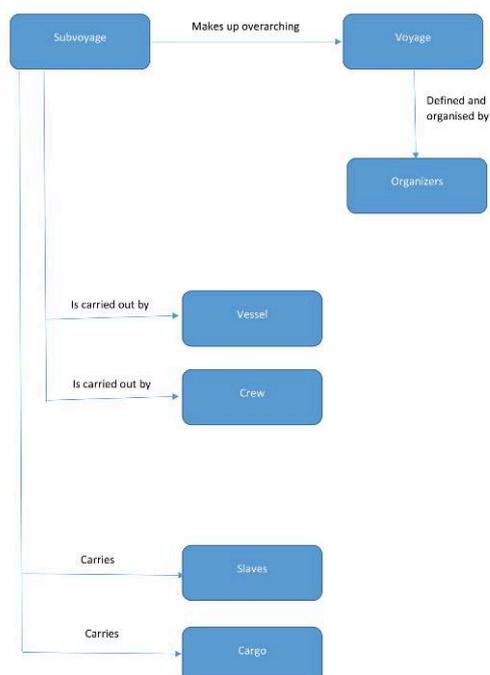
50   In this model the 'sub-voyage' becomes the main unit of analysis. Each sub-voyage row or entry is given a unique identifier through which relationships between the sub-voyage and the other entities in the sources can be identified and documented. In the sub-voyage table then, all the unique sub-voyages are recorded, and the desired attributes of analysis are recorded in the form of column variables. Each of the related tables can then record the data specifically relevant to that entity: so all details relating to the vessel (flag, type, tonnage, rig) are recorded in a separate 'vessel' table; all details relating to the organizers of the voyage (outfitters, insurers, trading company, owner of the vessel) are recorded in a separate 'organizers' table; all details relating to the crew on board the voyage (total numbers, nationalities, names, employers) are recorded in a separate 'crew' table; all details relating to the amount of enslaved people onboard (total numbers, sex distribution, age distribution) are recorded in a separate 'slaves' table; and finally all attributes relating to the cargo carried by the vessel (types, units and volumes) are recorded in a separate 'cargo' table. The main advantage of this is to structure and organize the data in a way that maintains clarity and ease for the database user by grouping the attributes according to the entity they are related to; what this essentially means is that attributes relating to individuals on board a vessel (for example) do not need to be subsumed under one entry which also needs to detail geographical data, mortality rates, chronological data, and events that affected the voyage underway.

B. A 'Forced Relocation' relational database model

Illustration 2. Forced Relocation Structure

51   Conceptually the organization of the database does not differ much from the relational model based on sub-voyages (Appendix A). The separate entities remain the same, with the exception of the (multiple) sub-voyage entity which gets replaced with the (singular) forced relocation entity. The relations between the entities remain largely unchanged, except for the cargo table which becomes linked to the voyage table, rather than the sub-voyages.

C. Testing the relational database models:

52   The two voyages outlined below have been taken from the two primary datasets currently being used to design and develop the Indian Ocean Maritime Asia Slave Trade Database pilot. The way they are written below reflects the way the information is currently stored in the individual datasets; the variables used to structure the database have been noted on the left and the information contained in the corresponding voyage entry cells on the right.

Voyage status	Confirmed
Vessel name	Ruby
Flag	French
Identity	European
General result	Successful
Place where voyage began	Reunion
Region where voyage began	Mascarene Islands

1st place of slave purchase	Fort Dauphin
Principal place of slave purchase	Fort Dauphin
First region of slave purchase	Madagascar
Principal region of slave purchase	Madagascar
1st/2nd/3rd place of slave landing	NA
First region of slave landing	Mascarene Islands
Principal region of slave landing	Mascarene Islands
Year arrived with slaves	1723
Date voyage began	07/10/1722
Date trade began	1722
Date vessel arrived with slaves	01/1723
Captain's name	Grenier
Number of slaves arriving at first place of landing	36
Number of slaves disembarked at first place of landing	36
Total slaves disembarked	36
Percentage women	11,11111
Percentage male	88,88889
Sources	AN: COL C/3/4, report 1723; COL C/4/1

Source: Hooper 2019.

Nom Navire	Ruby1
Tonneaux	120
Navire	Frégate
Armateur	CdI
Capitaine	Grenier
Lieu de départ	Maurice
Date de départ	07.10.1722
Date d'arrivée	NA
Lieu	Malage (entre Ste. Marie et Fort Dauphin)
Date d'arrivée 2	08.12.1722/07.01.1723
Lieu d'arrivée	Bourbon via Maurice
Esclaves	65
Sexe	27h, 18g, 20ff
Sources	SHL/1P/305 & COL/C4/1 & MAR/4JJ/90 & ADLR/C1366 & NAF/9344

Source: Thiébaut 2018.

53 Mapping the above entries onto the relation models results in the following two visualizations of the entries.

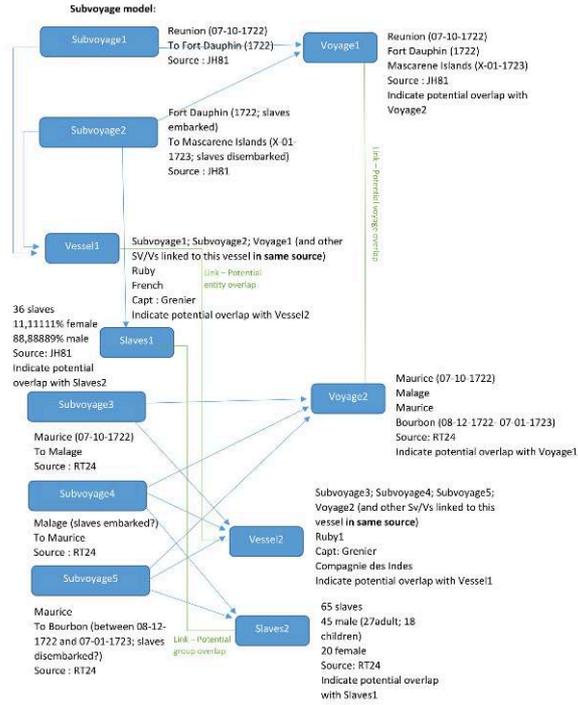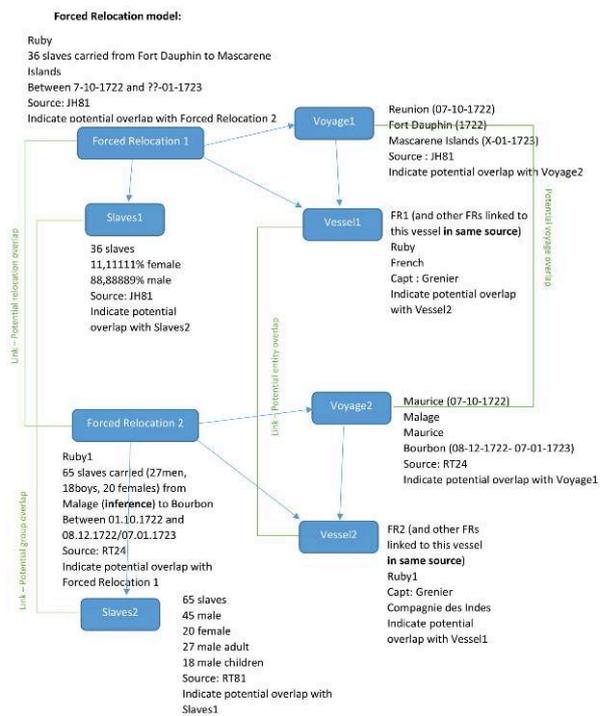**Illustration 3. Test of Sub-voyage Structure**

**Illustration 4. Test of Forced Relocation Structure**

54   The overlapping date of departure, vessel name, captain name and month of voyage end (indicated by the green arrows between the entity rectangles) all point towards these entries being duplicate entries. Bringing these entries together in order to eliminate double-counting gives another insight into the challenges facing us. Whereas Hooper's data notes the transportation of 36 enslaved people, Thiébaut's notes the transportation of 65. These discrepancies do not necessarily contradict each other; Hooper's group of 36 slaves could easily fall within Thiébaut's group of 65 slaves. This is especially likely given that both datasets cross-reference the same primary sources. What remains unclear is whether Thiébaut's group of 65 slaves is a cumulative total of slaves embarked as part of later port stops, or whether this higher number reflects the wider spread of sources consulted. This further complicates the question of relating cumulative totals of slaves transported across a whole voyage, to specific sub-voyages or even forced relocation entries. In a sub-voyage relational model, we face the question of breaking down the cumulative totals across individual port stops; this issue is not resolved by the forced relocation model which also requires the accurate geographic assignment of the forced relocation of a group from a place of origin to a place of destination. We cannot assume that the 65 slaves in Thiébaut's entry all embarked the ship at the same place, and so in bringing these two entries together, we face the question of best practice in dealing with discrepancies in numbers (do we adopt the maximum of 65, or the highest common denominator of 36?) as well as the practical question as to which tabular level of the relational database to relate the numbers to.

55   Both original datasets list the same date of voyage departure, but where Hooper's data lists Réunion as the place of departure, Thiébaut's data lists Mauritius as the place of departure. Subsequently, where Hooper's entry lists Fort Dauphin as the place of slave

purchase, and only vaguely lists the region of the Mascarene Islands as the place of disembarkation, Thiébaut's entry details the ship movement as landing in Malage, before returning to Mauritius and then finishing its voyage in Bourbon (also known as Réunion). Again, the discrepancies do not necessarily contradict each other. Thiébaut's dataset informs us that Malage lay somewhere between Fort Dauphin and the island of Sainte Marie just off the coast of Madagascar, and other than an overlapping departure date, no other concrete dates for port calls along the way are listed. However, the discrepancies do raise the question of how two such entries could be merged. We cannot assume, for example, that just because Mauritius lies east of Réunion, the voyage started in Mauritius before calling at Réunion on its way west towards Madagascar; nor can we ascertain whether the *Ruby* called at Fort Dauphin before or after the stop at Malage. Thiébaut's entry details the vessel returning to its departure place of Mauritius as a mid-voyage port of call before finishing its voyage in Réunion, further underscoring the myriad web of possible routes and stops carried out by ships sailing in a region of much more geographical proximity between known slave trading ports than is the case in the Transatlantic context.

D. A graph-based model

56 Mapping the two voyages from Appendix C onto a graph database model results in the diagram below:

Illustration 5. Graph Model Structure
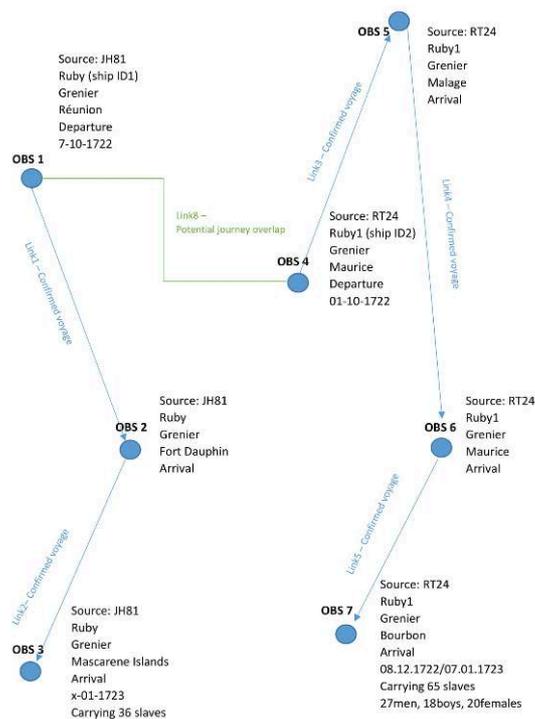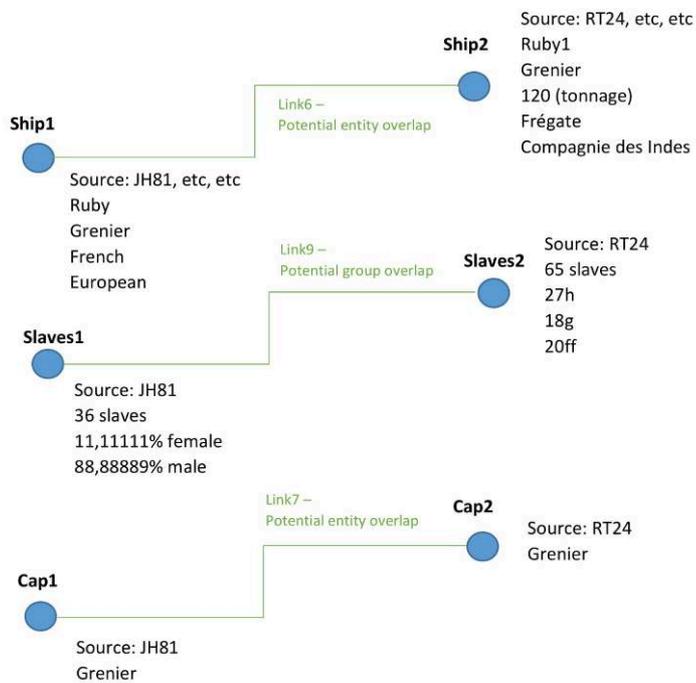
57   In this model, the multiple observations captured within Hooper and Thiébaut's data entries are separated and given linking IDs that specify the concrete nature of the link between the multiple observations on the basis of the primary source they are taken from. Each observation is only ascribed the qualities that are associated with it in the source; the database is given structure through the linking edges, and the attributes ascribed to those links. When a user inserts queries into the database they can pull up all the observations relating to a particular vessel, port or other keyword attribute or entity.

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NOTES

1. Eltis and Hooper estimated that the slave trade export to Indian Ocean destinations totaled some 392,000 slaves from Madagascar, 600,000 slaves from East Africa, and 400,000 slaves from the Red Sea area in the 16th to the 18th centuries. A large part of this is attributed to the French slave trade; for example, the French slave trade to the Mascarenes is estimated by Richard Allen at some 311,383 to 358,215 slaves in the period 1670 to 1848. For the entire slave trade in the Indian Ocean, Richard Allen estimates 'a minimum of 1,100,000 slave exports from eastern Africa to the Middle East, South Asia, and various parts of the European colonial world'. Paul Lovejoy estimated that the East Africa slave trade may even have amounted to 2,118,000 slaves in the seventeenth to nineteenth centuries (Lovejoy 2000: 62, 156; Hooper & Eltis 2013: 361; Allen 2015: 19, 23).

2. The ESTA-project is hosted at the International Institute of Social History in close collaboration with the Bonn Center for Dependency and Slavery Studies, Linnaeus University and ENS Lyon. The funding was awarded in the *NWO Internationation in the Humanities 2018 Grant Programme*. More information: https://iisg.amsterdam/en/research/projects/slave-trade-asia (last accessed, July 2020).

3. The dataverse can be found: https://datasets.iisg.amsterdam/dataverse/iomastd (last accessed, July 2020).

4. This article is based on the pilot conducted within the ESTA-project on a collection of databases available for the western Indian Ocean. During the kick-off workshop (2018) of the project, it was decided to start the pilot project for the design and testing of the data model with the regional case of the western Indian Ocean. There were several reasons for this. Most notable was the fact that more data was already collected in existing datasets for this region than for any other in the Indian Ocean and Indonesian Archipelago regions. Much of this data was organized in datasets similar in structure to the TASTD, while their authors and the existing literature at the same time stressed the multi-directional character of the slave trade common to the wider world of the Indian Ocean and Indonesian Archipelago.

5. The Intra-American Slave Trade Database can be found at: https://www.slavevoyages.org/american/database (last accessed, July 2020); The African Names Database can be found at: https://www.slavevoyages.org/resources/names-database.

6. David Eltis' Methodology essay accompanying TASTD can be found at: https://www.slavevoyages.org/voyage/about.

7. Alex Borucki and Greg O'Malley's Methodology essay can be found at: https://www.slavevoyages.org/american/about.

8. David Eltis' Methodology essay accompanying TASTD can be found at: https://www.slavevoyages.org/voyage/about

ABSTRACTS

While over the last three decades the *Transatlantic Slave Trade Database* (TASTD) has mobilized an astounding scholarly energy, the history of the slave trade in Asia has so far remained underdeveloped. Although numerous scholarly articles have indicated the widespread presence of slavery and the slave trade throughout maritime Asia from the early modern period well into the 19th century, estimates for the slave trade in the Indian Ocean are still tentative, and tend to focus especially on the (western) Indian Ocean region. Since 2015 an international group of researchers has come together to work towards consolidating research on the slave trade in Asia and East Africa. This article discusses a core activity of this group, namely the development of the Indian Ocean and Maritime Asia Slave Trade Database (ESTA) which is hosted at the International Institute of Social History in close collaboration with the Bonn Center for Dependency and Slavery Studies, Linnaeus University and ENS Lyon. We explore and evaluate the applicability of the Trans-Atlantic Slave Trade Database to the Asian context. We subsequently identify the specificities of the Indian Ocean and Indonesian Archipelago sources and patterns of slave trading, and their implications for possible datamodel designs. The article further underlines the importance of the ESTA database for comparative research reaching across colonial powers, local and global systems of slavery, across wider-ranging and more strongly defined 'regions' within the Indian Ocean Maritime Asia world, and even beyond to the transatlantic slave trade. A vital aim in the construction of a comprehensive Indian Ocean and Indonesian Archipelago database is the recording and reconstruction of the slave trade, especially in light of the entanglements of global long-distance slave trading with local systems of slavery and forced labour. The article identifies several challenges in the exploration of the historical and historiographic contexts and proposes and evaluates two database models, concluding with the advances made and the challenges ahead.

Au cours des trois dernières décennies, la constitution de la *Transatlantic Slave Trade Database* (TASD) a mobilisé une énergie étonnante au sein de la communauté des chercheurs : l'histoire de la traite des esclaves en Asie n'en a pas pour autant été approfondie jusqu'à présent. Bien que de nombreux articles fassent état de l'étendue de l'esclavage et de la traite des esclaves à travers l'Asie maritime depuis les débuts de l'époque moderne jusqu'au milieu du XIXᵉ siècle, l'importance de cette traite dans l'océan Indien reste encore sujette à des estimations, qui ont tendance à se concentrer sur la région occidentale de l'océan. Depuis 2015, une équipe internationale de chercheurs se réunit pour mener un travail collectif de consolidation des recherches sur la traite des esclaves en Asie et en Afrique orientale. Le présent article décrit l'une des activités principales de cette équipe : le développement de l'*Indian Ocean and Maritime Asia Slave Trade Database* (ESTA) hébergée par l'International Institute of Social History, en collaboration étroite avec le Center for Dependency and Slavery Studies à Bonn, l'université Linnaeus (Suède) et l'ENS de Lyon. Nous étudions ici dans quelle mesure le modèle de la TASD

peut s'appliquer au contexte asiatique. Il s'agit en outre d'identifier les particularités des sources et des modes d'activité propres à la traite des esclaves dans l'océan Indien et l'archipel indonésien, afin d'en comprendre l'impact sur l'architecture des modèles de données éventuels. La base de données ESTA apparaît comme très importante pour conduire d'éventuelles recherches comparatives qui engloberaient les pouvoirs coloniaux, les systèmes locaux et mondiaux de l'esclavage, en comprenant des régions toujours plus étendues et mieux définies au sein de l'océan Indien et de l'Asie maritime, et même la traite des esclaves transatlantique. La construction d'une base de données exhaustive pour l'océan Indien et l'archipel indonésien a pour but de documenter et de reconstituer le système de traite des esclaves, inscrits dans l'enchevêtrement de la traite mondiale à longue distance d'une part, et des systèmes locaux d'esclavage et de travail forcé, d'autre part. L'article identifie divers problèmes inhérents à l'étude des contextes historiques et historiographiques : deux modèles de base de données sont ici proposés et évalués, avant de conclure sur les progrès réalisés et sur les problèmes qui restent à surmonter.

Aunque en los últimos treinta años, la elaboración de la *Transatlantic Slave Trade Database* (TASD) movilizó con sorprendente energía a la comunidad científica, la historia de la trata de esclavos en Asia no ha sido todavía profundizada. Numerosos artículos señalan la amplitud de la esclavitud y de la trata de esclavos en el Sudeste asiático marítimo, desde los inicios de la época moderna hasta mediados del siglo XIX, sin embargo la importancia de esta trata en el océano Índico sigue sujeta a estimaciones que tienden a concentrarse en la región occidental del océano. Desde el 2015, un equipo internacional de investigadores se ha reunido para llevar a cabo un trabajo colectivo de consolidación de investigaciones sobre la trata de esclavos en Asia y en África oriental. Este artículo describe una de las actividades principales de este equipo: el desarrollo de la *Indian Ocean and Maritime Asia Slave Trade Database* (ESTA) alojada por el International Institute of Social History, en estrecha colaboración con el Bonn Center for Dependency and Slavery Studies, la Universidad Linneo (Suecia) y el ENS de Lyon. Lo que nos interesa aquí es ver en qué medida el modelo de la TASD puede ser aplicado al contexto asiático. Se trata además de identificar las particularidades de las fuentes y de los tipos de actividad propios a la trata de esclavos en el océano Índico y el archipiélago indonesio, con el fin de entender el impacto sobre la arquitectura de modelos de datos eventuales. La base de datos ESTA se presenta como un elemento importante para llevar a cabo eventuales investigaciones que integren los poderes coloniales, los sistemas locales y mundiales de la esclavitud, incorporando regiones cada vez más amplias y mejor definidas dentro del océano Índico y del Sudeste asiático marítimo, e incluso la trata transatlántica de esclavos. La creación de una base de datos exhaustiva para el océano Índico y el archipiélago indonesio tiene como meta documentar y reconstituir el sistema de trata de esclavos, inscrito en la maraña de la trata mundial de larga distancia, por un lado, y de los sistema locales de esclavitud y de trabajo forzado, por otro. El artículo identifica diversos problemas inherentes al estudio de los contextos históricos e historiográficos: dos modelos de base de datos son aquí propuestos y evaluados, antes de concluir sobre los progresos realizados y los problemas que todavía deben ser superados.

Durante os últimos trinta anos, a constituição da *Transatlantic Slave Trade Database* (TASD) mobilizou uma energia admirável no seio da comunidade dos investigadores. No entanto, a história do trato de escravos na Ásia não foi aprofundada até agora. Embora muitos artigos tenham estabelecido a presença da escravidão e do trato de escravos através da Ásia marítima desde os primórdios da época moderna até os meados do século XIX, a importância desse trato no Oceano Índico permanece condicionada por estimações que tendem a enfocar a região ocidental desse oceano. Desde 2015, uma equipa internacional de investigadores realiza um trabalho coletivo de consolidação das pesquisas sobre o trato de escravos na Ásia e na África oriental. Este artigo apresenta uma das atividades principais desta equipa: o desenvolvimento do *Indian Ocean*

and Maritime Asia Slave Trade Database (ESTA), albergado pelo International Institute of Social History, em colaboração estreita com o Center for Dependency and Slavery Studies de Bonn, a universidade Linnaeus (Suécia) e a ENS de Lyon. Analisamos aqui como o modelo da TASD pode ser aplicado ao contexto asiático. Trata-se igualmente de identificar as particularidades das fontes e dos modos de operar específicos do trato de escravos no Oceano Índico e no arquipélago indonésio, para entender o seu impacto sobre a arquitetura dos modelos possíveis de dados. A base de dados ESTA surge muito importante para desenvolver investigações comparativas, que envolvem os poderes coloniais, os sistemas locais e mundiais da escravidão, abrangendo regiões cada vez maiores e melhor definidas no seio do Oceano Índico e da Ásia marítima, e mesmo o trato de escravos transatlântico. A constituição de uma base de dados exaustiva para o Oceano Índico e o arquipélago indonésio visa documentar e restituir o sistema do trato de escravos, participando, por um lado, do emaranhado do comércio mundial de longa distância e, por outro, dos sistemas locais de escravidão e de trabalho forçado. Este artigo identifica alguns problemas inerentes ao estudo dos contextos históricos e historiográficos, propondo e avaliando aqui dois modelos de base de dados, antes de concluir sobre os avanços realizados e os problemas que ainda precisam ser superados.

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