The DIME project - Background, status and future perspectives of a user driven recording scheme for metal detector finds as an example of participatory heritage

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ABSTRACT
In September 2018, the DIME portal was officially launched to facilitate the user driven recording of metal detector finds produced by members of the public. The concrete and operational aim of DIME is to provide a portal for the registering and hence safeguarding of the increasing number of metal detector finds and to make them accessible for the general public and for research. The more overarching vision behind the DIME project is to realise the potential of recreational metal detecting as a medium to implement an inclusive and democratic approach to heritage management in Denmark and to advance the incorporation of principles of citizen science and crowdsourcing in museum practice. This article intends to present the background of the DIME portal's development, its basic functionalities and their technological underpinning as well as the overarching vision behind DIME.

ARTICLE HISTORY
Received 13 March 2019
Accepted 06 August 2019

KEYWORDS
DIME; Metal detecting; Detector finds; Database; Find recording; Citizen science; Crowdsourcing; Participatory heritage

Background of DIME

Over the last decades, recreational metal detecting practiced by amateur archaeologists has produced some of the most significant archaeological discoveries in Denmark. The formal heritage sector, from the very beginning of metal detector archaeology in the late 1970s and early 1980s pursued a liberal model based on cooperation and inclusion rather than confrontation and criminalization. Since then recreational metal detecting has developed into an increasingly popular hobby, and the number of trea-

Figure 1. Two situations symptomatic for the cooperative nature of recreational metal detector archaeology in Denmark. Top: museum curator and amateur finder during one of the recurring 'find-evenings' arranged by the Funen based amateur archaeologist association Harja and the five archaeological museums in the Funen area (Photo: Bo Grønhøj). Bottom: Large scale metal detector surveying at Hindsholm, Funen on the occasion of the annual 'Bifrost rally' in 2013, arranged by Harja in cooperation with Østfyn's Museer (Photo: Claus Feveile).

sure trove ('Danefæ') finds has skyrocketed; a trend that looks as though it will continue in the years to come. (Figure 1)

Recreational metal detector archaeology is a subject of great controversy and official stakeholders' attitudes and practical approaches towards the phenomenon differ across Europe and within individual countries.[1] In Denmark, both the general public and the official heritage sector generally consider recreational metal detecting a positive contribution to Danish archaeology. Not only has it radically altered the understanding of central aspects of Scandinavian societies during the metal-rich periods, it has also opened new research perspectives. Furthermore, as an integrated tool of heritage practice, metal detecting has secured an important part of cultural heritage and ensured the identification of countless archaeological sites which otherwise would have been in danger of irreversible destruction (Henriksen 2005; Andersen & Nielsen 2010; Baastrup & Feveile 2013). The success of the liberal Danish model, where everyone is free to use metal detectors with the landowners' permission, except protected sites and monuments, is based on a complex interplay of legislative, historical, cultural and social parameters, which to a large extent are specific if not even unique for the cultural context of Denmark (Dobat 2013).

Although also internationally acknowledged as a success story of Danish Archaeology, the rising popularity of recreational metal detecting has led to a number of problems, both for the growing community of detector users and the heritage sector (Ulriksen 2012; 2014; Feveile 2015; Dobat 2016). The lack of a national strategy and an appropriate infrastructure to support the central recording of finds has led to a situation where the enormous research potential of detector finds across local museum collections is difficult to exploit. In Denmark, a comparably large number of local museums have the archaeological responsibility in a given area (including conducting all development driven archaeology). This entails the collecting and recording of metal detector finds from the museum's area of responsibility and forwarding them to the National Museum for evaluation under the treasure trove 'Danefæ' scheme ('Danefæ' legislation under part 9 of the 'Consolidated Act on Museums'). However, only a small fraction of the many old and new finds is accessible to the broader public today. The enormous number of finds handed over to local museums and the Danish National museum have developed into an administrative burden at the affected institutions; and have in fact resulted in a collapse of the load capacity within the system.[2] (Table 1)

Representatives of the heritage sector have long called for a central infrastructure facilitating the recording of detector finds and the administrative workflow under the treasure trove (Danefæ) scheme. Detector users have expressed similar attitudes or started on the development of digital tools for find recording and display.[3]

Until now, different recording practices and formats have been applied in the recording of metal detector finds at the Danish museums, ranging from traditional analogue recording in handwritten journals over standard and partly user-generated excel spreadsheets to existing central recording portals used by museums and the Danish heritage agency (Slots- og kulturstyrelsen). However, the various systems used until now were designed to primarily support administrative processes but do not support the use of metal detector finds for research or public dissemination. The best place for the public, detector users and heritage professionals alike to keep track of new finds and gather research data have been user driven Internet platforms and social media fora (detectingpeople.dk; Facebook Group 'Detector Danmark'). Hence, in their treatment of the growing number of detector finds, the Danish museum sector has until now hardly complied with the ideals of public accessibility, usage, research and enlightenment which underline current international and national heritage legislation, and which often are emphasized by policy and decision makers.

Building bridges – goals and principles of the DIME project

In 2016, and thanks to a generous donation by the KROGAGER FOUNDATION, Aarhus University (Andres Dobat) initiated the development of a user driven recording platform for metal detector finds. A first version of the DIME platform was designed by Peter Jensen and the Unit of Archaeologi-

Year	Σ Unique finds(sent to the NM for Danefæ evaluation)	Σ Unique finders*** (who received Danefæ compensation)	Σ treasure finds*	Σ Danefæ compensation (DKK)	Σ members FB group 'Detektor Danmark'	Σ members FB group 'Detektor Danmark' (with detectors)****
2011	?	202	3,001	?	?	?
2012	3,061	?	3,412	856,600	100	?
2013	4,333	?	4,367	1,184,373	?	?
2014	7,176	?	5,312	3,044,100	1,000	?
2015	9,756	?	3,516	4,231,775	2,000	?
2016**	17,055	251	5,004	3,661,950	3,000	652
2017**	14,364	379 (?)	9,634	3,160,000	4,000	653
2018**	17,385	447 (?)	21,971	7,680,000	5,066	655

Table 1. Recent developments in annual numbers of finds and finders as well as total amount of Danefæ (treasure trove) compensation, in Denmark (data: Danish National Museum). For a statistic over annual find numbers before 2011 see Dobat 2013.

*Σ treasure finds does not necessarily reflect Σ of incoming finds per year but more institutional priorities and level of investment in Danefæ processing at the National Museum in given time interval.
** All numbers are subject to change due to the backlog of the Danefæ processing at the NM, i.e. the many Danefæ cases still in process.
*** As Danefæ legislation also applies to non-metal finds, an unknown (though very small) part of unique finders are not metal detectorists.
**** according to polls conducted among group members.

cal IT at Aarhus University and Moesgaard Museum, and was launched on 20th September 2018.

The initial development of DIME was part of a research project, based at Aarhus University and was overseen by a larger project consortium, which also involved Moesgaard Museum (Mads Holst & Stine V. Laursen), Nordjyllands Historiske Museer (Torben Trier Christiansen) and Odense Bys Museer (Mogens Bo Henriksen). Throughout the development process, the project group cooperated intensely with future users, in particular Danish detectorists and museum professionals.

From its inception the project consortium behind the DIME portal have worked towards a user-driven platform that would build a digital bridge between different user-groups: Danish metal detectorists, curators at the Danish museums, the general public, and researchers. The more specific goals guiding the design and development of the scheme were:

- To ease and expedite the recording workflow and **administrative processing** of detector finds at Danish Museums.
- To make detector finds and contextual data and information accessible to the **broader public and researchers**
- To provide a recording tool for amateur detectorists, functioning as a **digital find-diary** enabling them to keep track of finds and sites
- To provide a technological foundation that **stimulates and enhances cooperation and exchange** between amateur practitioners, curators and researchers
- To provide a central forum for **disseminating and promoting best archaeological practice** in the field when searching for and recording public finds
- To support **migration and sharing of data by other central databases** both on a national level (The Sites and Monuments Record, MUD, the SARA system) and on an international level (e.g. ARIADNE)

As prerequisite to achieve these goals, the design and development of DIME was governed by a number of basic principles:

- **User engagement**: DIME would encourage metal detector users to record their own finds, i.e. to upload basic data (GPS coordinates and images) and to at least attempt to provide data (dating frame, classification, description, etc.) for finds. In addition, DIME would facilitate knowledge exchange between finders and allowing users to provide feedback on each other's finds.

- **'Simple is beautiful'**: Given the very heterogeneous composition of the Danish detector community, the ambition of user engagement required a broadly accessible and 'intuitive to use' user interface and data structure that would both enable the less experienced user to fulfil minimum requirements, while at the same time allowing the more experienced user to provide additional data and information.
- **Interoperable data**: In light of the current development towards digital infrastructures and increased data exchange across dispersed datasets and repositories DIME was to be designed as a portal facilitating direct migration of data into other data repositories and collection management tools, both on a national and an international scale (e.g. MUD, SARA, ARIADNE, etc.)
- **All finds are valuable**: As the legally based differentiation of treasure-trove and non-treasure-trove has resulted in different registration standards and an unfortunate division of institutional responsibility (local museums versus Danish National Museum) DIME was to be designed to accommodate the recording of all finds, disregarding their potential status under the treasure trove scheme or their chronological context.
- **Open source**: To enable other metal detecting, heritage management and research communities to re-use elements of the DIME portal in the development of comparable portals for other contexts, the system should be built using exclusively open source technology.

During the first two months after the portal's official launch (as of May 2019), more than 1330 detector users have joined the community and uploaded all together more than 26700 individual finds. In addition, employees from 28 museums have been granted 'museum-user access' rights and the respective institutions have begun to incorporate DIME into their administrative practice.

Participatory heritage – the vision behind DIME

Danish metal detector archaeology embodies some of the celebrated hallmarks of Danish Archaeology with its long tradition for broad public appeal, inclusive discourse, citizen involvement and decentralized structure of the formal heritage sector (Kristiansen 1981; Lyngbak 1993; Hansen & Henriksen 2012). For the practitioners it is a recreational hobby, but it is also a legitimate way of entering into a dialogue with the past. In the case of the latter, it is genuinely democratic in character as it provides a means for members of the public to directly and actively engage with tangible elements of cultural heritage, disregarding educational, cultural or social preconditions. Instead of passively consuming expert knowledge and narratives, detector users cherish the idea of actively contributing to the writing of history with their findings – a claim that both detector associations and individual practitioners actively promote as being their most central incentive (Dobat 2013; Dobat & Jensen 2016).[4]

In this light, the Danish case of recreational metal detecting and the DIME project resonate well with internationally recognised visions for the social relevance of archaeology and heritage; not least the ambitions of the European Faro Convention (Faro 2005), which in Article 12: access to cultural heritage and democratic participation, promotes the idea that human values should be at the centre of cultural heritage, and that everyone should be able "*to participate in the process of identification, study, interpretation, protection, conservation and presentation of the cultural heritage*".

The DIME project presumed that the individual members of the Danish metal detector community should (and are willing to) be integrated into the workflow of find recording. It therefore was one of the most noteworthy results of the '2015 Danish detectorists survey' (Dobat & Jensen 2016), that 83 % of the respondents expressed the wish to participate in the find registration process at museums (5 % replied not be willing to upload data).

The embracing of the principle of 'user engagement' was partly based on plain economical reasoning, as the growing numbers of finds is increasingly difficult to manage by professional staff at museums. Hence, user engagement in the sense of basic

voluntary support of the public sector, was chosen as a means to ensure the economic sustainability of future find registration, and to establish a functional model for the future management of incoming metal-detector finds in Denmark.

The main reason, however, why the DIME project aimed to develop a user driven recording portal was the ambition to stimulate and advance an inclusive and democratic approach to heritage management in Denmark. It was the vision of the project group that the DIME portal should function as a best practice example for the incorporation of principles of citizen science and crowdsourcing in museum practice.[5]

Engaging members of the public to contribute to the registration of their finds can be considered not only a more sustainable, but also a more rewarding path towards a solution of the capacity overload at many Danish museums. It at least holds the potential to not only lessen the administrative burden presently on the shoulders of professionals, but also to add additional value to metal detector finds as a forum and medium of public engagement with cultural heritage. (Figure 2)

Already the initial design and development of the DIME platform took form of a citizen science project, as the mapping of detector user's attitudes and practices as well as practitioners' ideas and suggestions were included as guiding principles for the design and implementation of DIME. The principles of 'citizen science' and 'crowdsourcing', i.e. Public Participation in Scientific Research (PPSR) (Bonney et al. 2009) have become increasingly relevant in very different branches of science over the past decades. Danish recreational metal detector archaeology typically falls into the basic level of PPSR as developed by Bonney et al. (2009):

'Contributory projects - initiated and designed by professional scientists for which members of the public contribute data'.

With few notable exceptions, the role of Danish detector users is limited to that of 'finders', as the majority of practitioners are rarely involved in the museum's analysis of finds and/or sites, or the development of guiding research questions and methodological frameworks for the further investigations of specific assemblages.

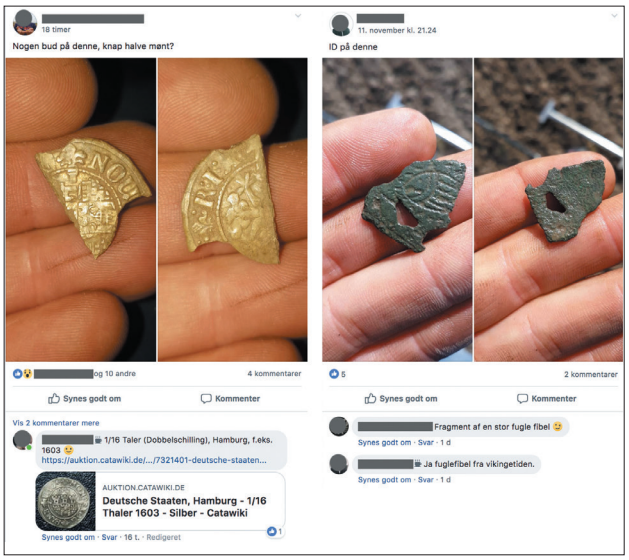

Figure 2. Typical examples for 'find posts' by detector users requesting ID (meaning classification and dating) in the Facebook group 'Detektor Danmark'. It is this existing practice for knowledge sharing the DIME portal taps into (picture: Facebook).

At the same time, however, many representatives of the Danish metal detector scene engage with not only 'their' finds and sites, but also with analytical aspects to a level that would justify their work as falling under a higher level of Public Participation in Scientific Research as developed by Bonney et al. (ibid): 2)

'Collaborative projects (initiated and designed by professional scientists in which members of the public contribute data and help to refine project design, analyse data and communicate results)'

And:

'Co-created projects (initiated and designed by professionals together with members of the public crowd, in which both parts are actively involved in most steps of the research process).[6]'

Recreational metal detecting in Denmark has challenged the classic division of roles in archaeology and heritage management, with amateur collectors producing finds but otherwise being more or less passive recipients of professional authorities' expert knowledge. At least a large part of the Danish detector community can be characterized as not only very committed to their hobby but also highly competent, both with respect to the recording of relevant contextual data in the field and the identification and dating of finds.

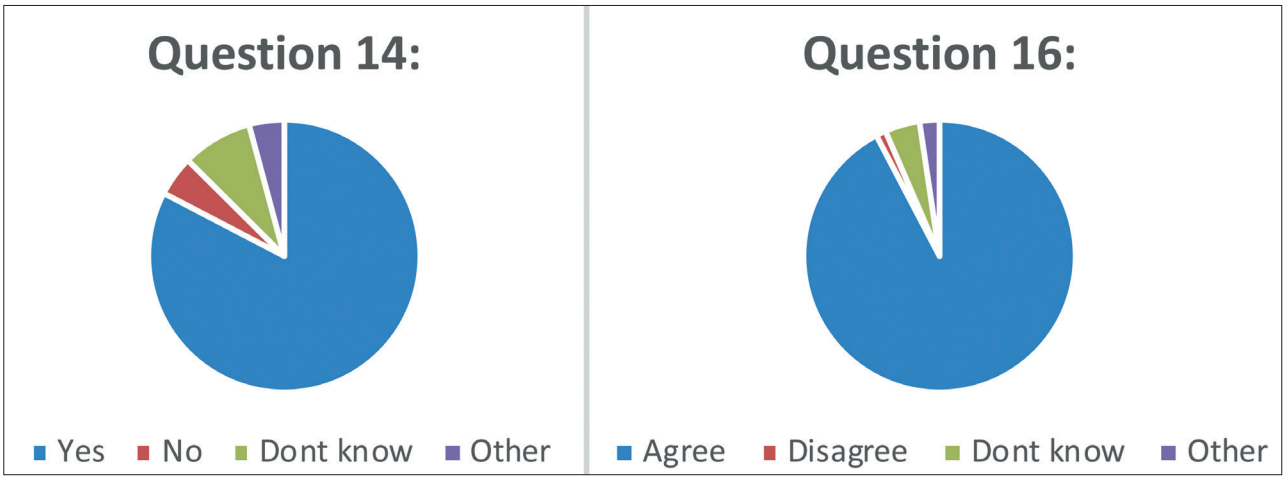

Table 2. Results of the '2015 Danish detectorists survey'. Question 14: Would you be willing to upload finds in a publicly accessible online scheme (provided that find-spots were hidden for members of the public and only accessible for archaeologists and researchers)? Question 16: Disagree or disagree to the following statement: I consider it important that finds and contextual data are accessible for archaeologists and researchers! (Data: '2015 Danish detectorists survey', Dobat and Jensen 2016).

The digital social media have played a crucial role in the building of know-how and competence within the Danish detector community. Especially the various Facebook groups (e.g. Detektor Danmark, CPE International ID Group, etc.) have proven to provide forums for exchange on the possible identification and dating of finds and even professionals are beginning to draw on the joint expertise and knowledge of these groups. In this way, the World Wide Web and digital media have facilitated public engagement and access to detector finds and in fact improved standards of archaeological work done by members of the public.

User-centred-design

To ensure that the DIME portal would be geared towards the needs of the stakeholders, the system has been developed on the basis on a mapping of existing practices and requirements for a digital recording portal among the different stakeholder groups, notably Danish metal detector users and Danish museum curators. As for the metal detector community, an online questionnaire was spread via Facebook (group 'Detektor Danmark') and the various detectorists associations, resulting in a total of 168 individual responses. The survey combined quantitative and qualitative data on detectorists' surveying and recording practices and attitudes towards find recording (for detailed presentation of survey results see: Dobat & Jensen 2016). More importantly, the survey and the following focus group interviews conducted with selected representatives of the user group provided constructive ideas and suggestions for the design and functionality of DIME. In order to map practices and requirements at Danish museums, interviews were conducted with curators with a special interest in detector finds from 27 local museums.[7] While different attitudes and conflicts of interest did emerge in the two surveys, the two user groups in fact concurred on the majority of issues, such as data formats and other implementation details or the strategic goal of the platform as a tool facilitating research, management (Danefæ workflow) and dissemination. (Figure 3)

DIME functionalities and specifications

In essence, the DIME portal supports the digital recording of artefacts (primarily metal detector finds), querying and geographical mapping of specific artefact types, and the further processing and export of find data and administrative data to other digital formats. Beyond that it allows other users to provide feedback to finders on the classification and dating of finds and supports communication between finders and responsible museum institutions.

As DIME is openly accessible, there is little reason to present its functionality in detail. Instead, the

curious reader is encouraged to visit DIME and take a tour, or see the short instruction movies, which are streamed via the DIME homepage (dime.au.dk). However, as certain modules are the restricted domains of certain user groups (e.g. the find administration module for museum users or researcher's access), an overview of the DIME system's functionality shall be given in the following.

User groups: The DIME system differentiates four main user groups with varying access- and editing rights in DIME: 1: 'public users' (members of the public without login), 2: 'finders/recorders' (typically amateur finders), 3: 'museum users' (curators employed at a Danish local museum), 4: 'researchers' (researchers affiliated with institutions in the heritage sector or university).[8]

Figure 3. DIME was designed, developed and tested in close dialogue with both of the two important user groups, the Danish museums and the Danish metal detector user community. Here one of several test events arranged in cooperation with Odense Bys Museer and Harja (picture: Harja).

Find recording module: After registration, anyone can enter data in the DIME system's find recording module. Registration of a find includes the obligatory upload of 1) GPS data and 2) at least one photograph and 3) entering of basic information on artefact type and material. In addition, users have the option to provide more detailed information, such as museum case number, the object's weight, dimension and secondary material as well as a free-text description etc. A number of mainly administrative information is generated per default, such as a unique DIME ID, finders ID. Via the GPS data, the find is per default linked with a municipality and the responsible local museum. Another important feature is the automated rejection of GPS values outside Denmark and beyond the low-water mark.

Crowdsourcing and citizen science: It's the explicit goal of the DIME project to facilitate the existing practice of peer-feedback and exchange among the practitioners and to enable DIME users to both receive and provide help in the classification and dating of finds. DIME attempts to realize this ambition by tapping into the already established channels of communication among Danish Detectorists and allowing finders to share finds directly on Facebook – preferably the purpose dedicated DIME ID group. The latter is partly administered and monitored by members of the detectorist community, highlighting the inclusive approach of the DIME project. Beyond the 'Facebook share option' DIME encourages user interaction by allowing all registered users to provide feedback on finds directly within DIME, for example an alternative classification or dating. Through this, DIME activates and uses the high level of competence and knowledge among the Danish detector users and allows the detector community to actively contribute to and participate in the enrichment of metal detector find data.

Find administration module and workflow: On recording finds are stored in DIME and become visible in the public view module. In a second step, a finder/recorder has the option to report a find to the responsible museum. Vice-versa the museum can also request a find to be reported. Finds can be accessed in the find recording module by 1) the finder/recorder and 2) the registered museum user for the given museum area. The later can edit the data provided by the finder (except GPS data) and/or add further information. Via the notification system, he or she can also request further information to be added in the find recording module.

In the find administration module both finder/recorder and museum users can see and query 'their' finds (for the finder/recorder only her or his own finds; for the museum user all finds reported to the respective museum). The module allows querying and selection of finds after specific criteria (finders ID, find spot, find metadata, etc.) and the migration of a data selection to other data formats.

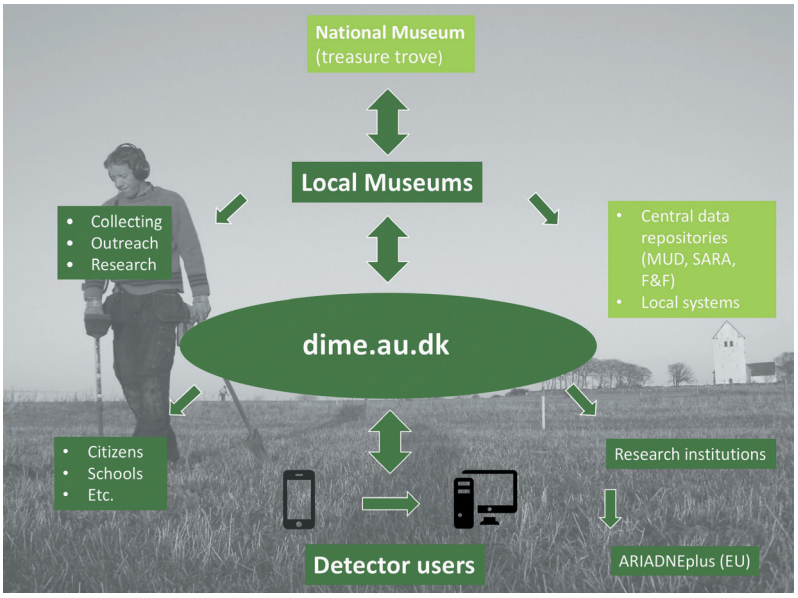

Figure 4. DIME and its relation and applicability in the wider landscape of archaeological heritage institutions, digital systems and stakeholders. Dark green: already established links. Light green: links under development or in design (picture: DIME).

Public and researchers access to the search module: On initial recording on DIME a find (and a selection of the attached metadata) is searchable by all user groups. Data are freely available, under a creative commons license (CC BY-NC-SA 4.0) for the academic and wider communities to use for their research. Public users and other users than the actual finder only can search and view selected information for all finds (personal information on the finder and the find spot remain hidden).[9] The mapping tool in the public search module allows mapping of single or combined search options (find types or find types & Period) as 'heat-map' on municipality level. Only the researcher's access provides near full data coverage for all finds (including GPS data) and allows the user to generate high-resolution maps over selected find categories or specific assemblages.

Support for mobile devices: The initial user requirement surveys and the various test-runs made apparent the need for an 'on site recording option', i.e. the possibility for an easy and direct recording of GPS coordinates and other data in the field, via a mobile device. To facilitate this user requirement, a DIME Mobile device version was developed, allowing GPS coordinates to be stored on the find spot and uploaded to DIME together with default updates of the find date, a unique DIME ID. DIME Mobile device version, however, only facilitates rudimentary recording of the object itself, and users are encouraged to complete a record on return to a stationary/desktop device. (Figure 4)

DIME user data are aligned with the current tendency towards an increasing usage of mobile devices away from stationary/desktop devices. More than 50 % of all finds records in DIME are at least initiated via the mobile phone user face. The developers focus on an 'on site recording option' thus helped acceptance of DIME within the detectorist community. Its downside, however, is evident in the many incomplete finds records, containing limited information and poor-quality photographs (as most detectorists are reluctant to spend much time on recording whilst detecting).

Data exchange and export: In order to ensure interoperability of data, the find database and the administration workflow uses the CIDOC Conceptual Reference Model (Crofts et al. 2011) ontology. Registration is based on the same chronological and classification system as it is used in existing national databases and collection management tools (MUD, REGIN). DIME data are thus interoperable with archaeological data from other sources and DIME (in principle) facilitates direct export and sharing of data with these existing data repositories. Various factors beyond the influence of the DIME board have until now prevented the establishing of direct links between DIME and the above-mentioned systems. Until then, DIME data can be exported via EXCEL documents in the find administration module.[10]

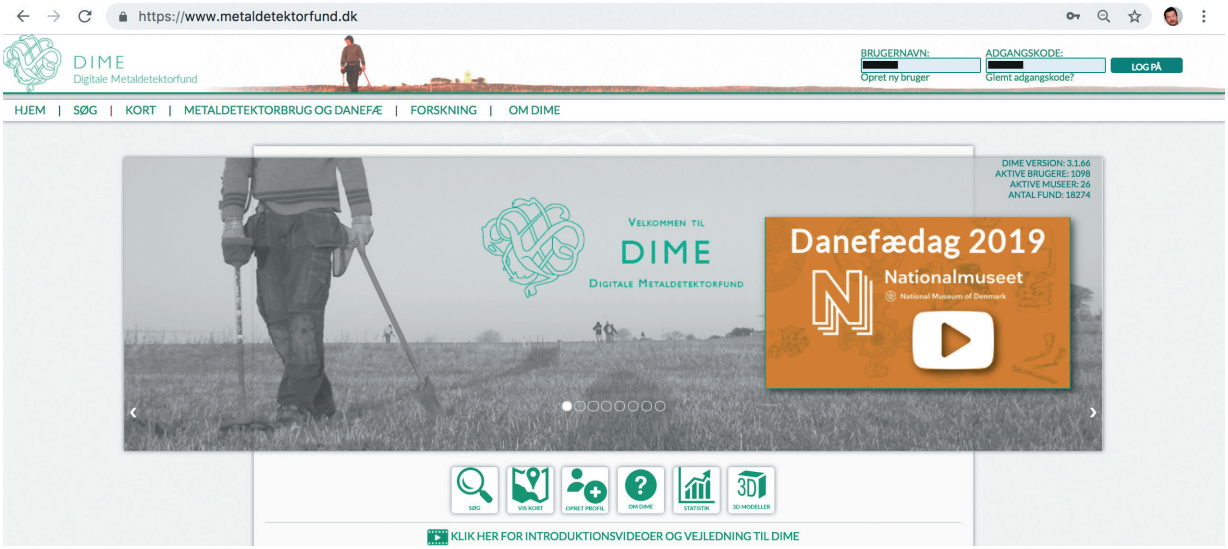

Figure 5. The DIME-portal's front-screen interface in PC-version for registered/logged-on users (picture: DIME).

It's all about the finder

In principle, all archaeological single finds, disregarding their chronological framework and material, can be recorded in DIME (also stone artefacts and ceramics!). However, DIME is anything but an all-purpose recording tool, and a specialized collector of stone age artefacts will find the DIME portal inappropriate for the recording of her/his finds.

One could argue that this strategy carries the danger of inevitably leading to a fragmentation and dispersal of the archaeological record. However, with the conscious decision in favour of a specialized portal for detector finds (and metal detector finders!), the working group acknowledged the need for a paradigm shift in the heritage sector's approach to find registration; a shift away from a traditional 'find-centred' to a 'user-centred' approach. In the development of DIME the group of people producing a particular type of archaeological finds was given priority as the governing parameter over the character and properties of the archaeological material (a find's dating frame, material, type, provenance, etc. or its legal status under the treasure trove system).

The focus on metal detected finds and 'detectorists' is rooted in the recognition of this particular stakeholder community as a potential resource. Despite being a highly heterogeneous group with enormous variations in levels of experience, knowledge, and willingness to cooperate with the official heritage sector, the general impression is that of a highly competent, skilled and well-connected community with a pronounced sense of group identity.

The decision to focus on metal finds, however, was also grounded in the progress of technological possibilities and attitudes within digital infrastructure development, away from all-encompassing and monolithic data repositories and towards smaller and flexible tools and solutions, linked by web-based services using common interfaces.

The success of a specialized data recording portal is dependent on the development of an infrastructure providing access to data and facilitating the exchange of data across repositories. Provided these conditions are in place, the same strategy that governed the design of DIME can be transferred to other interfaces between the official archaeological heritage sector and public stakeholders; e.g. amateur driven maritime archaeology. The growing community of recreational divers in Denmark who survey the seabed for submerged relics of the rich maritime pasts is characterized by similar challenges (and opportunities) as Danish recreational metal detecting archaeology (Jessen 2017).

Dissemination and user education

In order to promote not only the general acceptance of DIME, but also to advance and improve standards and best practice in find recording, emphasis has been put on the development of educational resources in DIME. Instead of a written manual, seve-

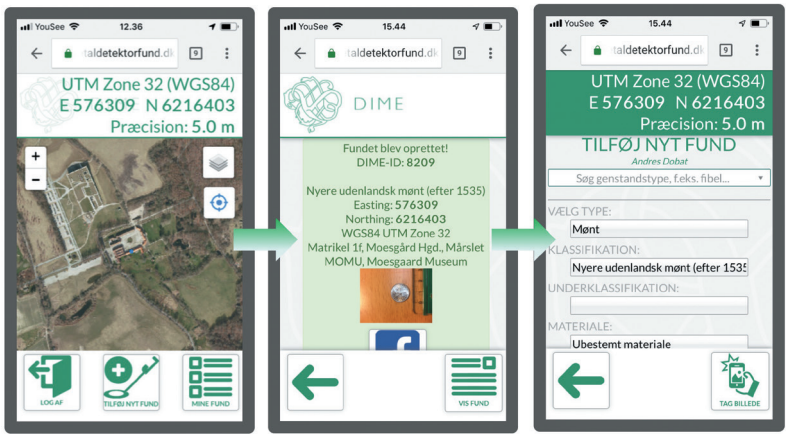

Figure 6. The DIME-portal user-face in the find recording module in mobile-version (accessible for registered/logged-on users). Left: prior to find registration, Middle: classification module; Right: Datasheet after successful find registration with DIME-ID Nr., basic location data and Facebook link (picture: DIME).

ral short videos, some featuring and even produced by well-known detectorists, introduce novices to the DIME portal, its basic functionalities and best recording practice. In addition, movie clips provide guidance on artefact photography and basic dos and don'ts of artefact treatment and storage are provided by a conservation expert. A number of additional help-features are under development, in many cases initiated and accomplished by members of the detector community. (Figure 5 and 6)

In our communication with the detector community, the DIME project group relies heavily on the existing exchange forums on Facebook, which currently is the most widely used channel for exchange among Danish detectorists. Also, the majority of detectorists who were included as experts and/or test-users in the development and testing phase were recruited via social media.

Experience gained during the first months following the launch of DIME indicate, that the high level of user inclusion both in the development and the production of educational resources was a crucial factor for the initial acceptance of DIME by the primary users. Several of the practitioners which had been drawn on earlier, took on a role as ambassadors for the DIME portal in the context of social media and acted as 'influencers' within the detector milieu. The commitment of certain 'super-users' of the DIME system eventually lead to the user-initiated establishing of a 'DIME support group' on Facebook, in which proficient users offer help to less experienced users of the DIME portal. In light of these developments, the vision of 'user engagement' has already begun to take very concrete form, beyond the original goal of data and knowledge sharing.

One important element of dissemination of best practice and user education is the flow of scientific results and knowledge back to the detectorist community. Researchers are only granted privileged access rights to DIME data for research projects on the condition that they provide a short summary of their projects results and allow DIME to post or link to relevant publications. We hope to create an awareness of the scientific value of metal detector finds and their contextual data in general. Particularly, we aim at creating an understanding of the scientific value of those less prominent find categories (scrap metal, production waste, etc.) which are often overlooked or considered meaningless by detectorists, but which can be of enormous value to researchers.

DIME and international trends and developments

Internationally, on one hand, Denmark is often seen as a positive example of the liberal model in European detector archaeology. On the other hand, when it comes to the registration, and hence the exploitation of detector finds in research and dissemination, the Danish case can be viewed as a tale of missed opportunities.

Danish metal detector archaeology has undoubtedly paved the way for research into new, previously unknown aspects of prehistoric societies (see for example: Henriksen 2000; Horsnæs 2010; Baastrup 2013; Ulriksen 2012; Feveile 2017; for additional examples see Dobat 2016, 57). However, the many old and new finds have yet to be fully appreciated as a primary object of archaeological research and detailed analytical studies across individual sites and regions.

Denmark has for a long time been lagging behind the developments in other European countries; not only when it comes to the handling of archaeological finds, but also with respect to more general approaches and trends within public management and the use of digital media in the humanities. In England and Wales, the Portable Antiquities Scheme (PAS) was established as early as 1996, serving as a tool for the central recording of archaeological objects found by members of the public (mainly detector finds), and making these finds publicly accessible to researchers and the general public alike (Lewis 2013).[11]

In the wider trend towards inclusive approaches in public management, the ideals of citizen science as well as the paradigm of digital humanities and Big Data, similar schemes have been or are being developed. Already in 2016, the MEDEA portal was launched in Flandern (Belgium). In contrast to the portable Antiquities Scheme, which is based on a regional network of Finds Liaison Officers, MEDEA is designed as a user-driven platform. As in the case of the DIME project, MEDEA encourages detector users to upload basic information and raw data directly (Deckers et al. 2016). In the Netherlands, the PAN (Portable Antiquities of the Netherlands) has been under development since 2016 and will facilitate recording of finds by members of the public (Kars & Heeren 2018). Most recently, a project consortium consisting of University of Helsinki, Aalto University and the National Board of Antiquities have joined forces under the project 'Finnish Archaeological Finds Recording Linked Open Database' (SuALT), which will provide a solution to the increasing numbers of detector finds in Finland (Wessman et. al 2019).

Organization and sustainability

As of September 2018, DIME has gone through the transformation from a grass-roots driven development project to an element of core operational practice at a growing number of museums. The DIME portal's future will be shaped by the DIME board, comprising representatives of the institutions belonging to the initial project consortium (Aarhus University, Moesgaard Museum, Odense Bys Museer, Nordjyllands Historiske Museer), plus representatives of the Association of Danish Amateur Archaeologists (SDA) and The Danish National Museum.

As the financial support received by the KROGAGER FOUNDATION only covered development costs, the future maintenance and further development of DIME is dependent on user contribution. The use of DIME as a recording tool will always remain free of any charges for the individual detector user, nor will public users or researchers have to pay for access to DIME data. However, DIME will ask participating museums (DIME partners) to contribute financially after a period of free use, when the system has hopefully proven to constitute a valuable tool for improving registration efficiency and quality at participating museums.

Unresolved issues and future challenges

In its current state, the DIME system provides a solution for the most pressing issues relating to Danish recreational metal detector archaeology, allowing basic recording and processing of the growing number of finds. However, there are several functionalities that are not yet supported by the system, or which until now have been impossible to be implement, either due to external factors or simple lack of time and sufficient funding. The success of DIME will depend on its ability to meet future challenges, to incorporate ideas and suggestions from users and to develop further. Some of the functions that either are in development or will need to be designed in the near future are:

- Site module: Option to upload information and data linked to a certain find spot (e.g. settlement, battle field, treasure find, GPS tracks, etc.) covering continuous surveying and several surveying campaigns and the possibility to link single finds to an overarching find category and provide a unique ID for e.g. a treasure hoard, a settlement site or fragments of one and the same objects.
- Flexible data sharing among users: Option facilitating the sharing of find data among a trusted group of detector users (in its current state, DIME does not reflect the social com-

plexity and dynamics characterizing parts of the detector community, where groups of detectorists or associations often share 'surveying rights' for a certain find spot – and hence also wish to share data).
- User's exhibition space: Option facilitating the user driven selection of certain finds and the curating of digital exhibitions around common themes or find assemblages from certain sites.

The two most central fields of future development are:

1. the implementation of migration and share of data with other databases, not least MUD, F&F and SARA
2. the role of DIME as a tool in the central processing of treasure trove (Danefæ) at the Danish National Museum.

The project group behind DIME is currently worked on both fields in cooperation with relevant partners. From the very beginning of development work, high priority was given to the integration of DIME with the new SARA system, hosted by the Danish Agency for Culture and Palaces. This dimension of the DIME portal, however, could not be achieved, for reasons beyond the control of the DIME working group. The SARA system until now has not materialized as a functional alternative to the existing systems.

One of the unknown factors influencing the future of the DIME portal is its acceptance by the metal detecting community. Experienced detectorists generally seem to agree on the basic necessity of a standardized recording of their finds and in the '2015 Danish detectorists survey' more than 83 % of the respondents confirmed to be willing to upload finds in a publicly accessible online portal (Dobat & Jensen 2016). From the start, DIME has been received very positively among the Danish detectorists. The fact that more than 800 detector users joined the DIME community during the first three months of its existence can be taken as indicative of that the constructive attitudes expressed in the '2015 Danish detectorists survey' are in fact followed up on through concrete action. However, it remains to be seen whether also the Danish Museum community will be willing and able to embrace the DIME system in the long run, and whether users will be sufficiently motivated and capable of providing data of sufficient quality to be used directly in the further processing by museum professionals.

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Digital systems mentioned in the text:

- **DIME**: Digitale Metaldetektorfund: dime.au.dk
- **MUD**: Museernes Udgravningsdata: http://www.udgravningsdata.dk/
- **SARA**: Fælles system til registrering og administration af museernes samlinger: https://slks.dk/museer/museernes-arbejdsopgaver/registrering/sara/
- **F&F**: Fund og Fortidsminder: http://www.kulturarv.dk/fundogfortidsminder/
- **REGIN**: https://www.kulturarv.dk/regin/index.do
- **PAS**: Portable Antiquities Scheme: https://finds.org.uk/
- **PAN**: Portable Antiquities of the Netherlands: https://www.portable-antiquities.nl/
- **MEDEA**: https://vondsten.be/
- **SuALT**: The Finnish Archaeological Finds Recording Linked Open Database

Notes

1. For an overview see the Open Archaeology (2016): Topical Issue on Aspects of non-professional metal detecting in Europe.
2. In 2016, Danish local museums spent 316 weeks (equivalent to 8 full-time positions) on the local registration and further administration of detector finds produced by members of the public (Pedersen et al. 2018, 11). This development has left not least the Danish National Museum's treasure trove administration struggling with a backlog of several years for certain artefact categories.
3. In 2015, a large proportion of Danish detector users 'samarbejdende detektorfolk' ('cooperating detectorists') came together for a workshop on challenges and possible solution of Danish detector archaeology. The lack of a central find recording database was unanimously identified as one of the most crucial deficiencies of Danish detector archaeology (Krause-Kjær 2015).
4. It has to be emphasised that also the Danish metal detector community is characterised by enormous heterogeneity in terms of motivations and incentives. According to museum curators working closely with detectorists, not all

are solely driven by the desire to contribute to historical knowledge and research. And when practitioners emphasise this particular aspect of recreational metal detecting towards heritage officials, the media or in surveys, it is also a direct response to the presumed expectations; i.e. detectorists may have other and less idealistic motivations (not least the monetary gain that comes along with treasure trove finds) but they provide the answers they know the public and professionals want them to give. Furthermore, the enormous media focus on gold artefacts and treasure finds has attracted participants with less idealistic and more pecuniary incentives to the hobby.

5. In this way, the DIME project resonates with current political and ideological ambitions towards civic empowerment and democratization of heritage management. The authors are well aware of the potential pitfalls of such an approach. Under different headings (e.g. 'Big Society'), governments across Europe are promoting the idea of increased civil contribution to public services like public health sector or eldercare, stirring debates across political positions and ideologies. The idea of involving metal detectorists in registration process of their finds thus carries the potential risk of being misused under a neoliberal agenda for legitimizing funding cuts.
6. Level 1 in Bonney et al. (2009) analytical hierarchy of Public Participation in Scientific Research can be dismissed here:http://www.birds.cornell.edu/citscitoolkit/publications/CAISE-PPSR-report-2009.pdf.
7. During the entire project period, presentations of the DIME portal in various contexts were used to encourage in particular museum curators to contribute to the development work with ideas on design and functionality of the DIME portal.
8. For detailed information on the registration process for the different user groups with editing rights in DIME and the requirements for DIME research access see the DIME homepage dime.au.dk.
9. The background of this is the somewhat competitive nature of recreational metal detecting and the increasing pressure on find producing surveying areas. While the majority of Danish detector users are willing to provide the exact location (GPS data) of finds and productive find spots to heritage officials, many are reluctant to make these data publicly available – and hence allow potential competitors to 'seize' the same search areas (Dobat & Jensen 2016). The DIME portal recognizes this particular user requirement of 'disclosed find spots' and limited data availability. This is despite the fact that the system's functionality thus contrasts with the ideal of open data access.
   The potential and limitations of the DIME portal as a tool facilitating Public Participation in Scientific Research are thus closely interrelated with the social dynamics and attitudes of the main stakeholders. Even though the restrictive policy with regard to research accesses is a compromise without alternatives, the future development of DIME will also have to focus on the systems further adjustment and alignment to the social dimension of recreational detector archaeology. In many cases, two or more detectorists share one or several search grounds (find localities) and thus have a vested interest to view each other's finds and data.
10. A direct data migration option from DIME to the central Danish heritage data repositories (Fund & Fortidsminder; SARA; MUD) is a priority in the future development of DIME.
11. Especially the Portable Antiquities Scheme for England and Wales can be drawn upon as an example of the enormous potential of a central recording of detector finds. As of January 2018, and according to the PAS' own assessment (https://finds.org.uk/research), the PAS has provided data for more than 600 research projects, among these 126 PhD projects, and single finds or distribution maps over particular artefact categories have been included in countless publications.

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