Original article

DEVELOPING A NEW NUMBERING METHOD FOR PAPYRUS THROUGH USING CO2 MACHINE AND U.V LASER PRINTER

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Abstract:

Numbering is a vital process in museums; it provides a unique identification for each object. Without numbering, objects cannot be tracked or utilized in a museum. Sometimes adding numbers to artifacts can be very challenging due to artifacts diversity in shape and materials. Numbering must be durable as it holds the identity of the artifact as it allows the curator to track it easily and retrieve information quickly. This number is connecting the object with its own other information such as; documentation, description and current condition of the object. A range of new numbering techniques appeared and practiced in many museums beside the traditional ones. This paper will point out and focus on one of new numbering method developed and planning to be applied for the first time on glass mount that hold papyrus in the Grand Egyptian museum through using CO2 marker machine and U.V laser printer. Both methods are tested on glass mount and results compared to select the better method to be applied. It was found that both methods provided sustainable numbering on papyrus mount. Numbers made by these two methods are durable and can't be removed from glass but, one approach was preferred over the other as it will be revealed in this paper.

1. Introduction

Numbers are used to uniquely identify items and to add it to the data base [1]. These numbers should serve as short hand for longer item descriptions. When a cultural object inters a museum, it is given an accession number which is unique number for each object [2]. Numbering is the process of adding a special number to object in order to identify it or distinguish it from other objects [3]. This special number is connected to a data base contains all the related information about this object which can be accessed using the number. Numbering methods could be added directly or indirectly on objects and differs according each case and type of artifacts [4]. Numbering process can be known also as marking or labeling process. Numbering is applied on cultural objects for three main reasons: **1)** Identification purpose, the number applied on object is the museum inventory number. Each object in a museum has a unique number and can be easily identified by it [5]. **2)** Facilitating management of the collection, new technologies can be used for

automatic identification such as bar codes. **3)** Security to prevent theft [4]. Numbering technique must be applied according to specific conditions and rules. Firstly, if numbers will be added directly on objects, it should be applied on the most durable and well condition part. In case of fragile objects, it should be in shape of tied labels. It must be added in accessible hidden place with a limited handling of objects [6]. The added numbers to objects should be readable but small to avoid distraction, from 2-5 mm on small to medium objects and 10 mm on large ones [7]. Although numbering of artifacts is considered vital for artifacts identity, few researchers have dealt with this topic. Delfino [8] discussed different methods of numbering and materials used on different types of artifacts. While Alten [6] reviewed selection of objects and the suitable methods of numbering them. Kite and Thomson [9] discussed the care and maintenance of leather objects including numbering by labels method. Buck, et al. [10] explained registration techniques used in museums and numbering indications for material types. Also, Gaylord Bros., Inc. gives general guidelines of numbering in different methods according to material type. Frösen [11] suggested for papyrus numbering, it is always preserved between two glass sheets for better preservation. Therefore, it's more suitable to add the number of the artifact on the glass mounting by adhering an acid free label with the number. Numbers in this case can be written by hand or printed by laser printers. From all previous it was notice the great variety of methods and techniques used in numbering [2,3,5]. However, the general guidelines that regulate numbering aren't clear enough. Besides suggested methods differ from institution to another which in need for further studying, explaining and testing [1]. As instance papyrus numbering in Egypt is preserved between two glass sheets for better preservation. Due to fragility of the mount of glass sheets of papyrus, the position of numbering is different. It can be written on the outside frame as mentioned before by Matassa [12], or lower right corner on the recto side or writing the number on the frame of the mount as applied in the British museum which later on numbers could faded away. The Museum, Archaeological Institute of Kashihara in Japan uses specific permanent inkjet CO_2 printers for printing directly on small artifacts of pottery and ceramics [13]. Thus, researchers inspired the idea of using permanent printing on objects and experimented it on the glass sheet that preserve papyrus in an attempt to develop and enhance papyrus numbering methods.

2. Methodology

This research includes an experimental study of testing new numbering methods on papyrus. The numbering method proposed is an indirect method applied on the glass mount of papyrus. Devices tested for glass mount numbering are CO_2 marker machine and U.V laser printer. Both methods are tested on glass mount and results compared to select the better method to be applied.

2.1. *Guidelines for numbering methods*

Numbering methods applied on cultural heritage artifacts should not harmful or cause damage. The position of the numbering should be accessible but not visible for exhibition. The number must be easy to read and it should be short as possible but, includes all related important information of the object [11]. Generally, the colour of numbers is white for the dark objects, black for the light objects and sometimes read as an alternative when the other colors are not suitable. Methods used in numbering should not be applied on colored, decorated or waxed areas. It's recommended to include the object's number in photographing to prevent losing the numbers. Each museum or institution must set specific methods for numbering each type of cultural heritage objects. Before using new chemical materials in numbering, experimental studied should be performed by conservators for approval.

2.2. *Methods of papyrus numbering*

Papyrus is always preserved between two glass sheets for better preservation [12]. Therefore, it's more suitable to add the number of the artifact on the glass mounting by adhering an acid free label with the number. Numbers in this case can be written by hand or printed by laser printers, or writing the number on the frame of the mount, writing on filmoplast tape as applied in the British museum, it was noticed that parts of the number faded away, fig. (1-a). Generally, documents and papers are numbered on the lower right corner on adverse side [14]. Due to fragility of the mount of glass sheets of papyrus, the position of numbering is different. It can be written on the outside frame as mentioned before, or lower right corner on the recto side. Or on the lower left corner on the recto side as applied in the Grand Egyptian museum, the number is printed on acid free paper label and adhered by acid free double face, fig. (1-b).
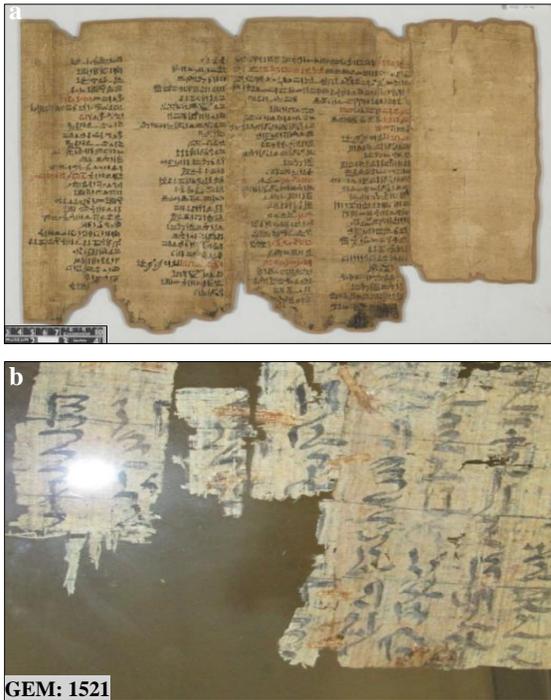
Figure (1) Shows **a.** the numbering technique applied on the frame of an object from the British museum collection [14], **b.** numbering method of papyrus using acid free paper label adhered with acid free double face.

2.3. *Problems of papyrus numbering*

Numbering is part of artifact protection and identity. When a new artifact arrives to a museum, it should have a special code or number called inventory number. These numbers are used to uniquely identify items and to add it to the data base [15]. These numbers should serve as shorthand for longer item descriptions. Numbers added to objects should be readable but small to avoid distraction, from 2-5 mm on small to medium objects and 10 mm on large ones [7]. Some institutions are still holding on traditional practices although they include some flaws and may cause some problems. As was mentioned before, the numbers should be durable and last for long time and shouldn't cause distraction [8]. Writing on the frame is durable for a period of time but, cause a distraction for the visitors and faded eventually. Also, the acid free paper labels couldn't provide a sustainable numbering method. The printed number on acid free label seemed to fed away after a short time, fig. (2).

Figure (3) Shows the printed number on acid free label fed away after a short time which threats the identity of the papyrus.

2.4. *Developing a new method*

Because of the previous methods couldn't be either sustainable or cause a lot of distraction. Some experiments were applied in order to test new methods and devices. Notice that the glass mount was numbered with this new method separately and before adding papyrus inside. The first method tested was the CO_2 laser marker machine, fig. (3).

Figure (3) Shows numbering with CO_2 laser marker machine, (the glass mount was numbered separately, by the authors.

This method simply depends on using a CO_2 laser source to melt quartz glass fibres. the printer stage can be moved by a system of three axes [16]. Device properties; CO_2 Laser marking machine 30W/40W/60W-wave length standard; 10.6μm Optional: 10.2 or 9.3μ, Print speed ≤12000mm/s, cooling system 30/40w Air-cooled 60w. CO_2 marker machine provides a permanent number. It can be used on paper, plastics, glass, wood and cardboard [17]. An annex software compatible with many file extensions such as: PLT, PCX, DXF, BMP…etc. the software is also designed to control the laser power in CO_2 marking system in order to change the wanted numbering according to the demanded writing language, size and range. The advantage about this method is its maintenance free, its applicable on various sizes of objects and materials such as: wood, leather, textile, paper, glass, ceramics, stones, plexi glass, plastic and rubber [18]. Besides the fast process of marking with automatic jump number and low failure rate. The device was tested on glass and gave a permanent result, fig. (4-a). The second method was the U.V laser printer (Roland versa U.V Lef2-300 Bench top U.V flatbed printer pri-

nting). Many materials can be marked such as textiles, acrylics, glass and silicone, leather and metal. It can print on previous materials in all different colours. [19] This device requires minimum maintenance as the device is air cooled and the components can last for long time. Glass was marked with the U.V laser printer. White was the colour chosen for printing as it would be easily readable, fig. (4-b).

Figure (4) Shows **a.** numbering with CO_2 laser marker machine on glass mount; then putting the papyrus was between glass sheets, **b.** final results of numbering by CO_2 laser marker machine (*left*) and U.V laser printer (*right*).

3. Results

Numbers applied by the two previous methods were very convenient. Numbers are permanent so objects are protected and connected with their own identity on museum system. The CO_2 laser source to melt quartz fibers glass. So numbers are permanent engraved on glass. The U.V laser printer works in different way. As it prints numbers on glass. The difference here is in U.V method numbers could be printed in any colour chosen. While the CO_2 laser method has one result in appearance. The CO_2 method was chosen to be executed on glass mounts of papyrus collection in the Grand Egyptian museum as it gives a convenient result as

the engraved numbers added to glass are visible and readable but in the same time not distracting. While the result of U.V method is very obvious and can be distracting for the eye to high level although, the method is permanent and applicable on various materials. Both numbering methods, the CO_2 laser and the U.V, are approved to be used in papyrus numbering but the researchers preferred the CO_2 method. When comparing these new technologies with the traditional and manual papyrus numbering methods, traditional methods can be considered temporary. As the number faded away by time or the adhering tape lose its characteristics of attaching the number to the glass. On the other hand, numbers made by CO_2 laser and the U.V method on glass are durable and can't be removed.

4. Discussion

The CO_2 laser machine method was selected for glass mount of papyrus in the Grand Egyptian museum. As it demonstrates a durable, sustainable and not distracting method of indirect numbering of papyrus. Although U.V method proved to be sustainable and long lasted method, it was very distracting for the eye. Thus this method was rejected for papyrus numbering. However, U.V printing method can be used in indirect numbering on other mount materials such as textiles, acrylics, silicone, leather and metal Thus, more experimental studies are needed to be executed on the previous materials to test the durability of numbering. It must be clear that these methods are recent and very few researches studied these methods in other fields of research. Therefore, the researchers recommend to apply more experiment studies on the two new methods in numbering of artifacts. The researchers disagree with the numbering methods applied in *The Museum, Archaeological Institute of Kashihara*. The museum uses special CO_2 printers to add permanent numbers directly on artifacts. This action is completely the opposite of the rules and guidelines as numbers could never be removed. The museum should reconsiders modifying this method and using it in indirect way and on different materials such as mounters or holders of artifacts. The researchers agree with Frösen on the importance of preserving papyrus between two sheets of glass, as well as, writing the numbers on the glass mount but, in different method. The CO_2 method provided a sustainable and safe papyrus numbering method. It's vital to include and test new technologies in order to facilitate numbering process in museums.

5. Conclusion

Numbering is a vital process for Identification or distinguishing objects. It also facilitates management of collections. Numbering is an important method to secure artifacts and preventing them from theft. Numbering could be applied directly or indirectly on artifacts. This matter differs according to the type of object and current case. Some institutions still hold on using old methods of numbering while others seek for new technologies. Numbering with CO_2 marker machine and U.V laser printer gave a sustainable and convenient method of numbering comparing with other traditional methods. Although acid free printed labels don't cause any damage to the papyrus, it could put the object in risk of losing identity as numbers could fade away easily. The same can be told on writing on papyrus frame. As numbered seemed to fade away by time. Using the CO_2 marker machine in papyrus numbering will save time and money and will provide better protection for artifacts in museums. In case of numbering the mount glass of papyrus, its recommended to use the CO_2 marker machine as it gives a convenient result as the engraved numbers added to glass are visible and readable but in the same time not distracting. This method is preferable than the U.V laser printer in mount glass numbering as U.V method is very obvious and can be distracting for the eye to high level. The U.V laser printer is recommended in indirect numbering methods. It gives the possibility to number many types of materials used as mount for artifacts such as textiles, acrylics, glass and silicone, leather and metal. It can print a durable and permanent numbers on previous materials in all different chosen colours.

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