The accuracy of forensic reconstruction

Forensic art, otherwise known as forensic reconstruction, is used by forensic anthropologists to construct the possible faces of missing or unidentified persons. These methods can help aid investigators in the identification of the unidentified and help with search and recovery of the missing. One of the most common methods used is age progression, in which a forensic artist will create, either by hand, computer, or a mixture of both, what the intended individual would look like at a certain age. This technique is specifically useful in missing persons cases, in which the person has been missing for an extended period of time and might not look the way he or she did at the time of the disappearance. However, there is no guarantee that the methods used in forensic art will be accurate enough for an identification. Since evaluation of age progression methods show a need to improve forensic art techniques and reliability and validity of age progressions is somewhat low, research shows that the accuracy of forensic art is fairly inaccurate.

In a study conducted by Andreas Lanitis, Lanitis attempts to create a dataset that will evaluate age progressions in order to generate more accurate outcomes. The goal of the data set is to retain features of the face that are most delicate to aging (Lanitis & Tsapatsoulis, 2014). This way, forensic anthropologists can produce age progressions of a specific individual at the correct age. The dataset Lanitis and his partner, Tsapatsoulis, are hoping to build upon is the FG-NET dataset. The two researchers are doing this by testing the aging differences of eight different facial features in hopes they will provide a more accurate picture. Though more work is being done on this research, Lanitis and a team of researchers conducted another study that

evaluates eight different age progression methods: Method 1, angingalbum, oldface, oldbooth, maold2, maold, abooth, and in 20y (Lanitis, Tsapatsoulis, Soteriou, Kuwahara, & Morishima, 2015). The purpose of this research study was to test which method out of the eight provided the most accurate results of an age progression. Lanitis and his team gathered images of 30 different people, of various ages, races, and genders. There were two pictures for each individual. Image A was a picture of the person prior to present day, while image B was a present-day picture of the individual. The researchers then showed the image A photos to forensic artists and asked them to produce an age progression of so many years so that they could compare the age progressions to the image B photos. Lanitis and his team used three methods to compare the age progressions to image B to find out the similarity of the two and which age progression methods are most accurate. The researchers concluded that oldface and method 1 provided age progressions most similar to that of the target individual. They further concluded that age progressions that involve children under 6 years old were almost allows inaccurate, supporting the statement that improved techniques must be created to provide useful images in investigations.

Two studies have been conducted at striving to advance current forensic reconstruction techniques to provide more accurate results. Researcher Eric Patterson and colleagues used a current dataset called, Wide Age-Range Progression (WARP) Image Set, to create a dataset that represents the elder population more effectively than current datasets (Patterson, Simpson, & Sethuram, 2014). The reason behind the research was to demonstrate the changing properties of the face over time, such as deformation in the face,

loss of collagen in the skin, and fine lines and wrinkles. Patterson and researchers chose to age progress the images found in the WARP database because it is supposed to show a greater range of ages than other datasets available, like FG-NET and MORPH. Researchers then compared to see if datasets with wider age ranges and diversity showed more accuracy in age progressed images. Patterson and his team found that this is true. The results lead researchers to believe that datasets that contain images of individuals from a number of age groups and ethnic groups provided more accuracy than other datasets. The team also found that datasets that contained images of just one gender had improved the accuracy of age progressed images compared to gender-combined datasets. In another study aimed at advancing current forensic art methods, Patterson and a team of researchers created a new technique for the active appearance model, otherwise known as AAM, which is used in age progression images (Patterson, Sethuram, & Ricanek, 2013). The AAM uses both shape and texture of a specific face in order to adjust the image and form a more realistic age progression model. While the old technique is also used to signify shape and texture in the face, vectors are laid on top of the original photo to create the age-progressed image, often looking unrealistic. The new technique proposed by Patterson and his colleagues draws on shape and texture, while warping the age-progressed image into the original photo to create the changes in the face due to aging, therefore creating the presence of nasolabial lines and forehead lines. These changes allow for a more accurate representation of the target individual, however, still limits the accuracy due to the absence of changes in the hair and neck caused by aging.

It is important to analyze the similarity between target individuals and age progressions to test the accuracy of the method. Charlie Frowd and his team of researchers wanted to test the likeness of age progressions and its intended individual, as well as the likeness of age progressions of an individual by multiple forensic artists. The researchers gathered photographs from volunteers at the ages of 5, 12, and 20, along with images of their relatives at those ages as well. The team then asked four different forensic artists to perform an age progression on each volunteer from the ages of 5 to 12, 5 to 20, and 12 to 20 (Frowd, Erickson, & Lampinen, 2014). Once the age progressions had been completed, Frowd and his team analyzed and compared the progressions to the actual images, as well as the progressions of the other forensic artists. The results from the experiment demonstrated that there was more similarity between the 5 to 12 and 12 to 20 progressions than the 5 to 20 progressions, suggesting that producing age progressed images are more accurate when the age gap is smaller. The researchers also concluded that the age progressions compared among each forensic artist was dissimilar to each other, indicating that experience and skill of the forensic artist may determine the precision of a progression. The experience and skill of forensic artists was tested in a study by William Blake Erikson. In his research, himself and his colleagues performed two studies. The first aims at testing the validity of age progressed images, meaning, does the image look similar to the individual, while the second aims at testing the reliability of age progressed images, meaning, will the image look similar among a variety of forensic artists (Erickson, Lampinen, Frowd, & Mahoney, 2017). They performed the experiment by having eight different forensic artists, each having a different experience and skill level, create age

progressions of eight individuals at three different ages in their life. When testing the validity of the progressions, researchers found that showing more recent photographs of an individual led to slightly more recognitions than the age progressions. However, the results from testing the reliability aspect of forensic art was significant. The study showed that the greater the difference in experience was between two forensic artists, the less alike their progressions of the same individual would look. The study also provided evidence that the larger the age range between age progressions, the less likely the image is to look like the target individual, raising the question as to whether or not other methods of forensic art should be used in missing or unidentified cases.

One technique of forensic art that could be more beneficial than age progressed images in dealing with unidentified bodies is facial reconstruction, which is the art of rebuilding the face of a person using their remains. Marek Joukal and a team of forensic anthropologists conducted a research study that practices using a facial reconstruction technique to identify the victims of severe head wounds. As of 2015, Joukal and colleagues used the technique on seven different victims who died of severe head wounds after being struck by a train (Joukal & Frishons, 2015). The technique involves detaching the bone fragments of the skull, placing the soft tissue onto a polystyrene head model, stitching the dermatomuscular flaps, and adjusting. This method allows researchers and investigators to distinguish identifying features likes scars and facial lines, as well as the eyebrows and facial hair. With the model of the newly constructed face, researchers could show a picture of it to potential family members to achieve

a positive identification of the victim. The technique has been successful in all seven cases and with further investigation and research, this method could prove to be extremely useful in the identification of unidentified bodies.

To conclude, forensic art in the form of age progressions and facial reconstruction will never give a truly identical representation of a missing or unidentified person. Numerous studies prove that there is more work to be done to improve these techniques. With almost 55% of all missing persons cases going unsolved, and 85% of unknown bodies remaining unidentified, it is crucial that new and improved methods are being developed to generate the most accurate results possible. (Erickson et al., 2017). However, based on research, it can be said that the current methods are of good use in the means of a last resort in an attempt to identify missing or unidentified persons.

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