

**UTILISING EYE-TRACKING TO TRAIN RADIOGRAPHY STUDENTS TO
FOCUS ON THE CORRECT ELEMENTS DURING X-RAY IMAGE ANALYSIS**

by

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Dissertation submitted in fulfilment of the requirements for the Degree

MASTER OF INFORMATION TECHNOLOGY

in the

Department of Information Technology

Faculty of Engineering, Built Environment and Information Technology

at the

Central University of Technology, Free State

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September 2024

Declaration

I, Tholoana Vero Motaung, hereby declare that this dissertation, entitled “Utilising eye-tracking to train Radiography students to focus on the correct elements during X-ray image analysis” contains my own work, with documented and acknowledged sources. This dissertation has not been submitted before for a higher qualification at another recognised learning institution.

The research was conducted under the supervision of Dr P.H. Potgieter, Prof. P.J. Blignaut and Dr B. Van der Merwe.

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9 September 2024

Acknowledgements

First and foremost, I would like to sincerely thank my supervisors Dr P.H. Potgieter, Dr B. Van der Merwe and Prof. P.J. Blignaut, for their support and help in my journey. Their insight, knowledge and patience have been a key to completing my work. Dr Van der Merwe, your encouraging words did not go unnoticed. Every time I felt like giving up, those unexpected WhatsApp messages gave me the strength to keep going and have truly helped me reach where I am today.

Furthermore, I would like to express my gratitude to National Research Foundation (NRF) and CUT M&D grant for providing the financial support. Moreover, I would like to thank the DRIC and FRIC committee members who had faith in my proposal and supported it.

This study would not exist if it was not for the participants who volunteered to participate in the study. Therefore, I would like to acknowledge with thanks the first year and fourth year Bachelors of Radiography in Diagnostics students from the Central University of Technology.

Lastly, my sincere gratitude extends to my family and friends, who have supported me greatly during this difficult period: My mother who did not even understand what I was doing but she gave me her unwavering support; my friends (Maneo Ramahlosi and Mpho Wittes) who had faith in me when I was on the verge of giving up.

I sincerely thank everyone who has contributed to my study in any form, your contribution did not go unnoticed.

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List of Abbreviations

2D	Two-Dimensional
3D	Three-Dimensional
ABS	Absolute
AI	Artificial Intelligence
AOI	Area of Interest
AP	Anteroposterior
CA	Correct Answer
CBL	Comparing both Lungs
CCA	Checking Costophrenic Angles
COVID-19	Coronavirus Disease 2019
CS	Clinical Sciences
CT	Computed Tomography
CUT	Central University of Technology
DoF	Duration of Fixation
HSREC	Health Science Research Ethics Committee
Hz	Hertz
kV	kilovoltage

mA	Milliamperage
PA	Posteroanterior
RO	Research Objectives
T2FF	Time to First Fixation
TB	Tuberculosis
UFS	University of the Free State
VR	Virtual Reality

Glossary

Area of Interest (AOI) is defined as the region of visual environment or display of interest for the study (Lupu & Ungureanu, 2013). For the current study, this refers to the area where the pathology is located.

Canva is an online design application that enables both individuals and businesses to produce a variety of visual content, such as flyers, posters, presentations, logos, social media posts, and graphics.

Eye-tracking is a technique in which the location of the eye is utilised to establish a person's gaze direction at a particular moment as well as the sequence of their movements (Lupu & Ungureanu, 2013). It has also been recognised and utilised as a tool for studying an individual's visual attention (Miseviciute, n.d).

Fixation refers to the eye's steady condition at a single point of regard (Alemdag & Cagiltay, 2018).

Fixation duration is a term that is widely used to describe the amount of time spent gazing at an area of Interest (Tobii Studio User's Manual Version 3.3.2., 2015).

Gaze behaviour is the eye movements performed by an individual when performing a task at hand (Ziv, Lidor, Zach, Brams & Helsen, 2020). For the current study, that is when examining the chest X-ray images.

Gaze plots represent gaze patterns (Lee et al., 2022).

Heat maps can be used to visualize blind spot identification (Lee et al., 2022).

Lesion is a part in a tissue or an organ that has endured harm through disease or an injury, for example, a tumour, abscess, ulcer or wound (Rendon et al., 2015).

Pathology relates to the general study of disease. It aims to identify the aetiology (cause) and pathogenesis (underlying mechanisms) of the disease while describing its symptoms, progression and outcomes (Reid, Roberts & MacDuff, 2011).

Radiography is a field that combines patient care safety with technology in one coherent practice (Malamateniou, Knapp, Pergola, Woznitza & Hardy, 2021).

Saccades refer to the rapid movements of gaze between fixations (Alemdag & Cagiltay, 2018).

Time to First Fixation is the time it takes for the participant to fixate on an AOI for the first time after the stimulus is displayed (Poole & Ball, 2006).

X-ray is a type of electromagnetic ray and interpretation of quantum mechanics (Behling, 2021).

Abstract

Eye-tracking technology is used in medical imaging to study radiographers' recognition tasks and visual searches. Eye-tracking technology helps radiographers analyse chest X-ray images by comparing gaze behaviour of experts and novices, assessing their abilities in analysing these frequently conducted examinations. This study aims to utilise eye-tracking technology to train radiography students to correctly analyse chest X-ray images. Additionally, the study's objective is to reveal the students' habits and trends during analysis.

To ensure that the best stimuli were selected for the study, a pilot study was conducted at the Central University of Technology (CUT). Participants were randomly selected from the Department of Clinical Sciences and were not part of the main study. Forty-one first-year students and 23 fourth-year students at the same university were recruited. This study adopts a pre-post experimental design, where the first-year group will participate in the study before and after the demonstration of the fourth-year students' gaze behaviour.

The study reveals differences in gaze behaviour between experts and novices in chest X-ray image analysis. This suggests that structured instruction based on expert gaze behaviour can assist novices to focus on correct pathological elements during chest X-ray image analysis. Additionally, the study reports the students' habits and trends during analysis.

In conclusion, the study demonstrates the effectiveness of understanding the gaze behaviour of novice and expert radiographers. Therefore, eye-tracking demonstrates that it can be of assistance to improve the performance of novice radiographers. Additionally, the integration of eye-tracking and radiography enhances education, training, and diagnostic procedures, and provides valuable

guidance for lecturers, enhancing gaze behaviour understanding and improving students' performance.

Chapter 1 – Introduction

This chapter will provide an overview of the study. It will discuss the background information, the problem statement, research aim and the objectives. Additionally, this chapter will focus on the research methodology, hypotheses, study outline, significance and limitations of the study. This will provide the reader with the purpose of the study.

1.1 Background

The most common examination in diagnostic radiography is a chest X-ray (Bar et al., 2015), however, it remains subject to frequent misinterpretation (Warren et al., 2023). Chest X-rays are important for managing different diseases that are related to mortality (Bar et al., 2015). Differentiating abnormalities from structures of the mediastinum, pulmonary arteries, bones and other complicated structures of the chest X-ray is a challenging task for radiographers (Del Ciello et al., 2017). According to Moncada et al. (2011), the qualitative interpretation of chest X-rays is very subjective and differs from observer to observer.

The issues related to X-ray misinterpretations may cause medical malpractice lawsuit and can have grave negative effects on patients (Warren et al., 2023). Similarly, the frequency of missed lung cancer cases is a serious concern and a substantial medicolegal challenge (Del Ciello et al., 2017). Lung Cancer has a very bad prognosis, with an average survival duration of less than 12 months (Hua, Hsu, Hidayati, Cheng & Chen, 2015). Thus, detecting lung lesions early improves the chances of survival (Hua et al. 2015). Additionally, identifying overlooked abnormalities and understanding their causes is essential to developing preventative measures (Warren et al., 2023).

Human beings perceive most information through their eyes, for example, when executing a professional task and when learning (Jarodzka, Holmqvist & Gruber, 2017). Chest radiography is frequently requested as a primary examination for a variety of illnesses (Mdletshe, Nel, Rainford & Lawrence, 2019). As a result, the student radiographer must develop pattern recognition skills to analyse chest images during training (Mdletshe et al., 2019). Therefore, computerised eye-tracking has been utilised to evaluate a radiographer's capability to interpret X-ray images (McLaughlin, Bond Hughes, McConnell & McFadden, 2017).

Eye-tracking monitors the position, movement method, and order of gaze throughout a task (Carter & Luke, 2020). Eye tracking makes it possible to study attention processes, such as which areas participants focused on first and for how long, what is focused on next and for how long, how often attention switches between areas, and how different parts are related to one another during these attentional changes (Alemdag & Cagiltay, 2018).

Eye-tracking has been utilised to supply feedback on the process of image interpretation and to provide an understanding on the image interpretation process (McLaughlin et al., 2018). Moreover, eye-tracking has been used to analyse the differences in gaze patterns between experts and novices and how novices can be trained (Venjakob & Mello-Thoms, 2015). With the development of eye-tracking technology, it is possible to measure visual search behaviour, evaluate cognitive processes, and examine how well people interpret stimuli (Arthur & Sun, 2022).

Eye tracking is widely utilised in medicine for assessing the visual behaviour of experts (Borys & Plechawska-Wójcik, 2017). Eye-tracking is a prominent technique in medical imaging that reveals how recognition and visual search tasks are conducted, offering information that may enhance human performance (Lévêque, Bosmans, Cockmartin & Liu, 2018). Deeper understanding of visual interpretation and diagnostic decision-making has been made possible by medical research

in several areas, including radiology, pathology, paediatrics, surgery, and emergency medicine (Brunyé, Drew, Weaver & Elmore, 2019). The current study focuses on how to train radiography students to focus on the correct elements during x-ray image analysis using eye-tracking.

1.2. Problem Statement

Lecturers find it difficult to structure their guidance for students when analysing chest X-ray images for pathologies (Kok, Geel, Merrienboer & Robben, 2017). Analysing a chest X-ray image for pathologies is difficult because the information is rich and it can be a challenge to select the right information (Bar et al., 2015). When analysing chest X-ray images, one of the biggest challenges is that three-dimensional (3D) structures are superimposed and shown in a two-dimensional (2D) plane, making interpretation more difficult (Gefters, Post & Hatabu, 2023). Literature on understanding radiological symptoms on the chest X-ray images is insufficient, scarce and often too succinct in textbooks (Delrue et al., 2011). Eye-tracking revealed that students do not fixate on the correct areas of interest (AOI) when analysing X-ray images (Turgeon, 2014), whereas experts tend to fixate on the correct area (Sánchez-Ferrer et al., 2016). When compared to novices, experts fixate on images for a brief period of time and have more and faster fixations (Richter, Scheiter, Eder, Huettig & Keutel, 2020). Therefore, methods that include analysing skills of expert radiographers are required to gain essential skills and to interpret X-ray images correctly.

1.3. Research Aim and Objectives

1.3.1 Research Aim

This study aims to use eye-tracking technology to guide radiography students on the correct elements to visit when analysing the chest X-ray images and how to correctly identify pathologies.

1.3.2 Research Question

The research question below was formulated to address different formats, namely:

- Relationship: The relationship between novice's pre-post eye movements was evaluated after the novices have watched the eye movements of the experts. For this study, fourth year radiography students were used to represent a group of experts while first year students were regarded as novices when examining X-ray images.
- Descriptive comparative: The same stimulus was used to test the novice before and after training.
- Causality comparative: The research question aims to test the effect of radiography experts' gaze behaviour on novice radiographers when analysing X-ray images.

The research question to be addressed in this study is:

To what extent does the gaze behaviour of expert radiography students influence the gaze behaviour of radiography students when analysing chest X-ray images?

1.3.3 Research Objectives

The aim was achieved through the following specific objectives:

- To collect gaze behaviour data from novice and expert radiography students.
- To analyse the gaze behaviour of the first-year students before and after watching the gaze behaviour of experts to inspect whether there was a difference in their gaze behaviour. To determine whether the gaze behaviour of experts influences the gaze behaviour of students.
- To report on possible trends and strategies that novice radiographers use to analyse an X-ray image.

- To provide an insight to radiography lecturers on how the use of eye-tracking technology can benefit radiography students during training.

1.4. Hypotheses

The study was conducted to test the following hypotheses. “Training” in this context refers to students watching the gaze patterns of expert radiographers when analysing different chest X-ray images.

H_{0,1}: There is no difference in the ability of first year students to compare the two lungs in an chest X-ray image before and after training. Students are required to inspect both lungs when analysing chest X-ray image. The measurement being evaluated is their ability to successfully compare the two lungs, which requires them to gaze at both lungs.

H_{0,2}: There is no difference in the ability of first year students to check costophrenic angles in a chest X-ray image before and after training. The students are required to check costophrenic angles for any abnormalities to determine the type of pathologies present. Students must assess the complete visualisation of costophrenic angles. Their ability to analyse costophrenic angles for abnormalities is being evaluated, including identifying pathology on the costophrenic angles, requiring both lungs’ costophrenic angles to be gazed at.

H_{0,3}: There is no difference in the ability of first year students to identify a pathology on a chest X-ray image before and after training. The students are required to analyse the chest X-ray images and identify the pathology present on the image. The assessment evaluates students’ diagnostic ability in accurately identifying chest X-ray pathology.

H_{0,4}: Time to First Fixation on the pathology in a chest X-ray image (if present) of first year students is not less after training than it was before training. Participants must focus on the correct

AOI to identify pathologies. The metric of Time to First Fixation indicates how long it took the participant to fixate on the correct AOI for the first time after the stimuli were displayed.

H_{0,5}: Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training. This metric indicates how long each fixation lasted within the AOI that covers the pathology.

1.5. Research methodology

Previous studies compared the gaze behaviour and the visual search patterns of expert and novice radiographers (Lévêque et al., 2018).

Experimental design, which includes experiments and observational studies, are commonly used for eye-tracking studies (Duchowski, 2007). For the current study, cross-sectional design was used, where data from the first-year students is compared to that of the fourth-year students. Additionally, the general pre-post experimental design is chosen, and the same students participated in the study before and after the gaze behaviour of the experts is demonstrated to them.

The gaze behaviour of novice radiography students will be analysed after they studied a set of X-ray images. The gaze behaviour of expert radiographers was then shown to the novice radiographers and the gaze behaviour of the novices was captured and analysed again.

1.6. Significance of the study

As stated in Section 1.2, this study is worth doing to guide radiography lecturers on how to structure their lessons when it comes to analysing and interpreting X-ray images. The lecturers will be able to reflect on their previous lessons with reference to eye-tracking recordings.

The study will investigate to what extent the gaze behaviour of experts influence the gaze behaviour of novices when analysing chest X-ray images. The study will then provide guidelines to lecturers on how to teach novices to analyse chest X-ray images for pathologies.

1.7. Delineation and limitations

This study will not deal with developing a learning platform for radiography students, but it will provide guidelines to radiography lecturers on how to use eye-tracking technology to train radiography students.

1.8. Outline of the dissertation

Figure 1.1 below presents the structured progression of the study, divided into five chapters. The figure was created by the author using Canva, which is an online design application that enables both individuals and businesses to produce a variety of visual content, such as flyers, posters, presentations, logos, social media posts, and graphics.

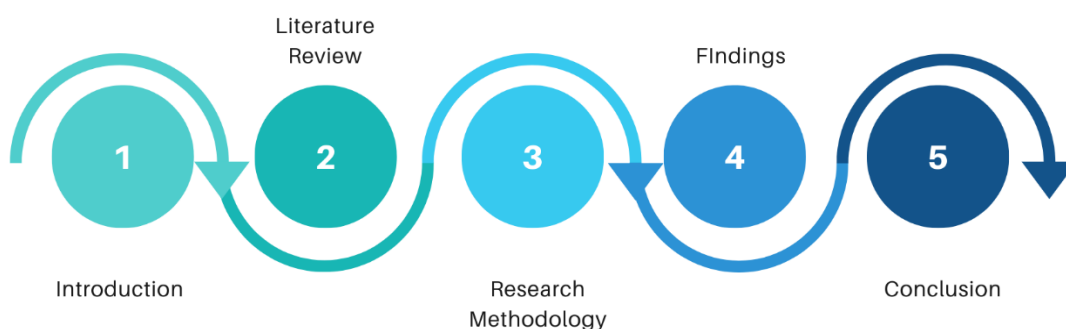


Figure 1.1: Chapter overview (created by author)

Chapter 1 is an introductory chapter and provides the purpose of the study. This chapter discusses the background information and reviews the problem statement, research aim and objectives. In

addition, the chapter focuses on the research methodology, hypothesis, study outline, the significance and the limitations of the study.

Chapter 2 focuses on previous studies related to eye-tracking and radiography. This chapter offers the reader a theoretical foundation relevant to the study.

The research methodology implemented in the study is discussed in Chapter 3. This chapter focuses on the methodological approach, data collection methods, data analysis methods and ethical procedures. This chapter also discusses the pilot study and elaborate on the research design and the methodology used, which includes (i) the design; (ii) the selection process of the X-ray images; (iii) how the data was collected and analysed; (iv) the ethical procedures followed; and (v) limitations. A pilot study was conducted to ensure that the most suitable stimuli are used for the study.

The findings are discussed in Chapter 4. This chapter will review the methods of data analysis and data presentation, the relevant data analysis results and it will also test the hypotheses. Lastly, the chapter will present the summary of results.

This study's final chapter, Chapter 5, will provide a thorough summary of the findings. It will address the research problem and revisit the hypothesis. The objectives of the study will be reassessed and recommendations for implementation will be presented. The chapter will also include a summary of the study's contributions, a discussion of the limitation and suggestions for future research.

1.9 Summary

This chapter gives a brief introduction to radiography and eye-tracking, which are the fields that will be explored in the study. It discusses the research questions; research aim and objectives; it also reviews the problem statement. It also outlines the other chapters that will be covered in this study. The next chapter will discuss other literary works that are related to the current study.

Chapter 2 – Literature Review

The previous chapter has given the reader an overview of the whole dissertation. This chapter focuses on an exploration of secondary literature. It will also provide an overview of previous work in the current field. This chapter discusses radiography and eye-tracking. It gives an overview of different chest pathologies and how to analyse chest X-ray images to identify those pathologies. It discusses imaging signs, as well as the diagnostic errors that novice radiographers make during X-ray analysis and the concomitant challenges. Eye-tracking applications are discussed later in the chapter. Furthermore, the literature on how eye-tracking can benefit the radiography field and how eye-tracking can contribute to learning, is discussed.

2.1. Introduction

Misinterpreting a chest X-ray by failing to make an early detection of abnormalities contributes to delayed diagnosis and treatment (Botelho et al., 2020). Early detection of abnormalities is crucial for medical professionals (Botelho et al., 2020). It is important to correctly interpret a chest X-ray since it is commonly used in radiography for lung and other examinations (Quen, Mountstephens, Teh, & Teo, 2021). Necessitating teaching methods that promote the production of pattern-recognition skills for anatomical areas is crucial (Mdletshe et al., 2019). One approach to do this is to utilise eye-tracking to examine how radiographers analyse images (Venjakob & Mello-Thoms, 2015). Medical care professionals can enhance their X-ray pattern recognition by utilising eye-tracking technology to observe the gaze movements captured.

Gaze duration, gaze pattern and dwell time help us understand the logic behind false negative and false positive radiological diagnoses (Botelho et al., 2020). Following visual search patterns of novices on X-ray images can create large data sets that can assist in understanding the logic behind

misdiagnosis (Botelho et al., 2020). Through eye-tracking, it is possible to track students' gaze on known abnormalities on X-ray images (Quen et al., 2021). Utilising eye-tracking allows the correction of common mistakes during medical training. Eye-tracking technology provides useful tools for improving understanding and correcting diagnostic errors in radiography.

A major goal of medical imaging research is to investigate the cognitive processes, visual search and perception of radiographers (Venjakob & Mello-Thoms, 2016). The goal is to improve diagnostic performance by understanding these characteristics better (Venjakob & Mello-Thoms, 2016). Previous eye-tracking studies have covered a variety of research areas that highlighted radiographers' cognitive processes, reading strategies and perceptual processes (Venjakob & Mello-Thoms, 2016). The current study highlights the possibility of training novice radiographers based on the gaze behaviour and visual search patterns of experts.

2.2. Radiography

2.2.1 Background

Diagnostic radiographers are usually the primary clinical imaging experts to engage with patients after they arrive for imaging examinations (DeMaio et al., 2019). Radiographers therefore have a responsibility to prepare examinations and guarantee that suitable medical imaging strategies are followed (DeMaio et al., 2019). For this reason, radiographers need adequate training when it comes to X-ray analysis.

Analysing a chest X-ray may seem easy but it is a complicated process that involves scrutiny and a clear knowledge of chest anatomy and pathology (Puddy & Hill, 2007). Radiographers are required to understand the anatomy of the body part being scanned since this information will help them identify pathology and evaluate how it affects the X-ray image (Sebelego, Van Der Merwe

& Du Plessis, 2019). Instead of only looking at the whole image, it is best to direct one's eye gaze to specific areas, since you are unable to pick up anomalies in your peripheral vision (Puddy & Hill, 2007). Radiographers must establish a search pattern and focus on areas of diagnostic significance when analysing the X-ray images.

X-ray images need to be observed frequently to improve technical skills and the production of X-ray images (Enfinger, 2015). Firstly, the problem must be identified, then the radiographers can find solutions to the problem (Enfinger, 2015). Radiographers need to be clinically ready and educationally prepared to perform their duties (DeMaio et al., 2019). It is, therefore, crucial to understand the basic physiological and anatomical techniques to be able to analyse an X-ray image correctly (Delrue et al., 2011).

2.2.2 Pathologies

Pathology is the study of diseases' cause, development and effects (Nakagawa et al., 2023). In addition, pathology also relates to the general study of disease, it aims to identify the aetiology (cause) and pathogenesis (underlying mechanisms) of the disease while describing its symptoms, progression and outcomes (Reid, Roberts & MacDuff, 2011).

Radiographers must have fundamental knowledge and comprehension of pathology, especially on how pathology affects exposure factors and how pathology appears on the X-ray image (Sebelego et. al., 2019). Knowledge of pathology provides the examination purpose and indicates which structures should be included to best illustrate a given pathology (Sebelego et. al., 2019). Accordingly, imaging experts must know how to thoroughly analyse the X-ray images and interpret pathologies correctly.

This study focuses only on the following pathologies: lung cancer, pneumonia, pneumothorax, pneumo-haemothorax and pleural effusion. These conditions offer a thorough framework for assessing visual search behaviours and cover a broad spectrum of lung diseases with differing diagnostic difficulties. Ganesan et al. (2018) state that enhancing abnormality detection requires an understanding of the elements that affect clinicians' visual search patterns. Furthermore, research such as that conducted by van der Gijp et al. (2017) emphasizes how crucial visual search patterns are for radiological diagnosis. These pathologies are discussed below:

2.2.2.1 Lung Cancer

Lung cancer is a distinct disease with numerous genetic changes (Salehi-Rad, Li, Paul, Dubinett, & Liu, 2020). Not observing lung cancer is a subject of worry amongst imaging specialists and a significant medicolegal issue (Del Ciello et al., 2017). When lung cancer is suspected, a chest X-ray is an initial investigation to be conducted (Panunzio & Sartori, 2020). In Figure 2.1, the chest X-ray image illustrates lung cancer presence in the left lower lobe. Appendix A represents lung cancer images that were used in the study.

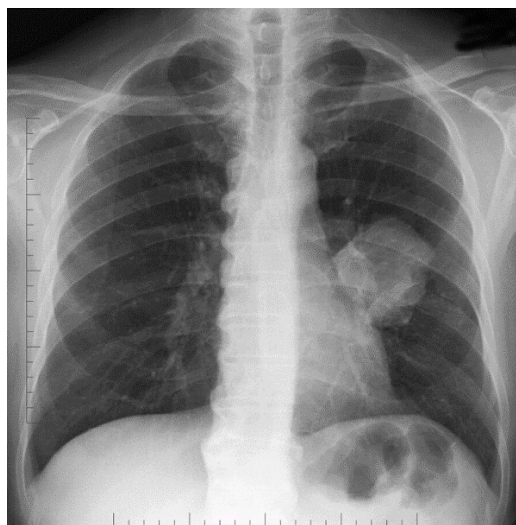


Figure 2.1: Chest X-ray shows lung cancer in the left lower lobe (File:Chest Xray.Jpg, 2016)

2.2.2.2 Pneumonia

Pneumonia is a pulmonary infection that causes lung consolidation (Das & Howlett 2009). Consolidation means that the air sacs of the lungs (alveoli) are filled with dense material and appear whiter (Panunzio & Sartori, 2020). Pneumonia is typically detected through an examination of a chest X-ray image (Gabruseva, Poplavskiy, Kalinin, 2020). The ability to identify symptoms of pneumonia on the chest X-ray will assist readers in assessing suitable treatment in the future (Das & Howlett 2009). As a result, knowing the appearance of pneumonia on the chest X-ray is critical for the good treatment of this common disease (Das & Howlett 2009). Figure 2.2 illustrates the presence of pneumonia in both the left lung and the right lung. Appendix A represents pneumonia images that were used in the study.



Figure 2.2: Chest X-ray shows Pneumonia in both the left lung and the right lung (Rad_doc, 2013)

2.2.2.3 Pneumothorax

The presence of air in the pleural space is referred to as pneumothorax (Ellis & Flower, 2006). Pneumothorax is a life-threatening condition that necessitates prompt communication and action (Goossen et al., 2019). Early detection is critical in order to prevent substantial morbidity or patient mortality (Goossen et al., 2019). In Figure 2.3, the chest X-ray image illustrates the presence of a

pneumothorax in the left lung. Appendix A represents pneumothorax images that were used in the study.



Figure 2.3: Chest X-ray shows Pneumothorax in the left lung (Sourced from department picture library)

2.2.2.4 Pleural Effusion

A pleural effusion is the accumulation of extra fluid between the pleura walls surrounding the lung (Serte, & Serener, 2020). Common causes of pleural effusion include cancer and pneumonia (Serte, & Serener, 2020). In Figure 2.4, the chest X-ray image illustrates the presence of pleural effusion in the right lower lung. Appendix A represents pleural effusion images that were used in the study.



Figure 2.4: Chest X-ray shows Pleural effusion in the right lower lung (Panjwani & Zaid, 2017)

2.2.2.5 Pneumo-haemothorax

A pneumo-haemothorax is a build-up of blood (haemothorax) and air (pneumothorax) in the pleural cavities, which refers to the membrane that surrounds the lungs (MD Anderson Cancer Center Madrid, 2023). The pleural cavity is made of two layers, the parietal pleura, which borders the diaphragm and the thoracic wall; and the visceral pleura which is the layer of pleura that surrounds the lung parenchyma (Burstiner & Khalili, 2023). Figure 2.5 illustrates the presence of a pneumo-haemothorax in the right lower lung. Appendix A represents pneumo-haemothorax images that were used in the study.



Figure 2.5: Chest X-ray shows Pneumo-haemothorax in the right lower lung (Sourced from department picture library)

2.2.3 Imaging Signs

Radiological signs form a collection of related pathologies or symptoms of a disease that can be visible on computed tomography (CT) or a plain X-ray (Kumaresh et al., 2015). This study focused on the plain chest radiograph which is referred to as the chest X-ray.

The silhouette sign was first defined and published in 1950 by Dr. Ben Felson (Khajotia & Rumi, 2019). Both Puddy and Hill (2007) and Khajotia and Rumi (2019), recognised it to be among the valuable signs on the chest X-ray. The cardiovascular silhouette is the outline of the heart shadow as observed in the anteroposterior (AP) (front-to-back) or posteroanterior (PA) (back-to-front) projections (Khajotia & Rumi, 2019). The silhouette sign defines the absence of a normal lung or “silhouette” created by any pathology that dislocates or replaces the healthy air-filled lung (Puddy & Hill, 2007). It also portrays the loss of the typical heart outline because of any effects of diseases that take over ordinary air-filled lung tissue (Khajotia & Rumi, 2019). If the cardiac silhouette is lost, it could indicate lung disease but if the cardiac silhouette changes in shape and size, it is a

sign of heart disease (Khajotia & Rumi, 2019). The sign in reference is usually used to check the mediastinum, heart, diaphragm and chest wall (Puddy & Hill, 2007). In essence, medical professionals use the silhouette sign to identify and locate abnormalities on the chest X-ray.

2.2.4 Analysing X-ray images

Radiographers should assess if the X-ray images acquired are best, as the X-ray images play an essential role when diagnosing patients (Sebelego et. al., 2019). Therefore, radiographers must ensure the correctness of technical exposure and positioning factors (Sebelego et. al., 2019). Additionally, it is crucial to include the Area of Interest (AOI) (Sebelego et. al., 2019); which refers to the specific region of focus for the particular study (Lupu & Ungureanu, 2013). For the current study, it refers to the area where the pathology is located. The chest X-ray areas that must be included during imaging are (Bontrager & Lampignano, 2017):

- The “apex” which refers to the upper, rounded region of each lung above the collarbones. They must be visible on chest X-rays.
- The “carina,” which can be seen as a point on X-rays where the trachea divides into the right and left main bronchi.
- The “base” refers to the lowest, concave portion of each lung that lies on the diaphragm.
- A “diaphragm” is a muscular layer that divides the chest from the abdominal cavity.
- The “costophrenic angle” is the peripheral lower corner of each lung, where the diaphragm and the ribs meet. Fluid accumulation can be seen at these costophrenic angles.
- To identify any problems, it’s critical to take chest X-rays that include both the highest regions (apices) and the lowermost corners (costophrenic angles).

- Each lung has a central part called the “hilum” or “root region” where the blood vessels, bronchi, nerves and lymph vessels enter the lung and leave.

In summary, radiographers need to know and understand these AOIs to be able to correctly analyse chest X-rays. Additionally, it is crucial to understand the basic physiology and anatomical techniques and limitations to be able to analyse X-ray images correctly (Delrue et al., 2011). Radiographers should significantly evaluate each X-ray image for the following (DeMaio et al., 2019):

- Artefacts – The undesirable X-ray image components that do not correspond to the anatomy of the patient and can impair the image’s diagnostic accuracy (DeMaio et al., 2019). It is crucial to ensure there are no obstructions before taking a chest X-ray. This involves taking off any clothing that has buttons, hooks, snaps or other objects that could appear as a dark shadow on an X-ray image (Bontrager & Lampignano, 2017), so that the X-ray can clearly show a patient’s chest without any artefacts interfering (Bontrager & Lampignano, 2017).
- Positioning accuracy – The accurate centring of the body component is critical while positioning. Because X-rays deviate as they exit the X-ray tube, radiographers must guarantee the centre anatomical structure concerning the image receptor (Sebelego et. al., 2019).
- Technical factors – To capture the needed details of the lung markings, the kilovoltage (kV) must be set at a high-level during X-ray imaging (Bontrager & Lampignano, 2017). When conducting chest X-rays, a low contrast setting is utilised, resulting in different shades of grey. To achieve this, a high kV setting is typically used, usually between 110 and 125 (Bontrager & Lampignano, 2017).

- Technical exposure factors – The kV range works like a power setting for the X-rays. Setting it too low will result in high-contrast images and this will not adequately display the lung markings, making it difficult to view the details behind them (Bontrager & Lampignano, 2017). However, setting the kV too high will make the heart and other vital areas appear too dark (Bontrager & Lampignano, 2017). Therefore, striking the appropriate balance is crucial.
- Underexposure – causes quantum noise in the X-ray image, which can impair the capability to see the detailed anatomical structures (DeMaio et al., 2019).
- Overexposure – causes loss in visual contrast all over the image, because of the increased radiation impacting the image receptor, and the image has a greyed-out appearance (DeMaio et al., 2019).
- Exposure time and Milliamperage (mA) – When taking chest X-rays, it is crucial to utilise a high mA and maintain a short exposure time, to prevent blurriness caused by motion (Bontrager & Lampignano, 2017). Additionally, ensure that the lungs and the mediastinal structures appear clear and bright on the X-rays (Bontrager & Lampignano, 2017).

There are two ways in which a chest X-ray can be examined (Bansal & Beese, 2019):

- Direct search: a technique whereby a particular pattern of inspection is followed.
- Free global search: a technique whereby an X-ray is examined without a biased pattern.

Figures 2.6, 2.7, 2.8, 2.9 and 2.10 presented below demonstrates the AOIs within the images discussed in Section 2.2.2. The red circles clearly mark the AOIs, which show the exact locations of the chest X-ray images where the pathologies are located. These are the areas the radiographers need to know and understand during chest X-ray analysis.

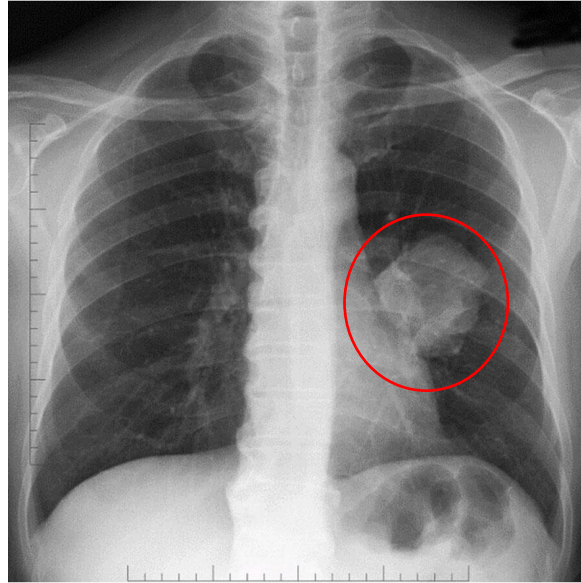


Figure 2.6: AOI on Lung Cancer X-ray image

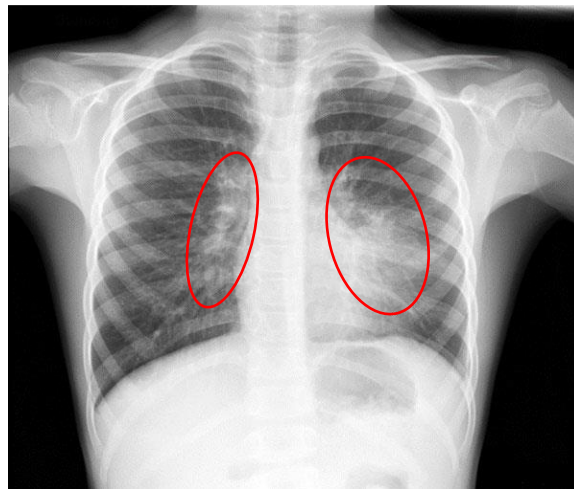


Figure 2.7: AOI on Pneumonia X-ray image

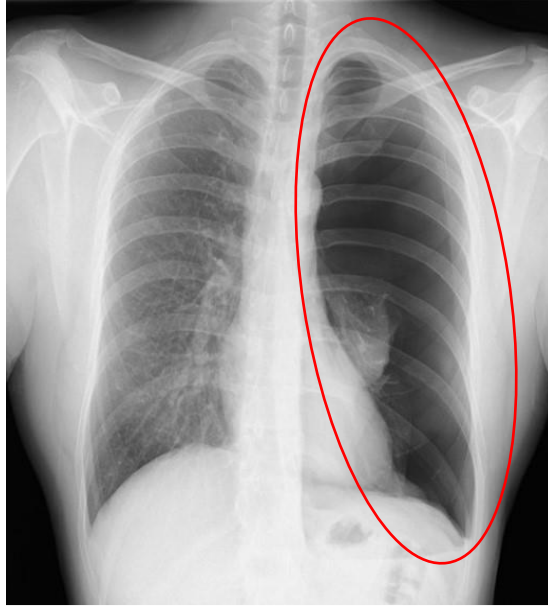


Figure 2.8: AOI on Pneumothorax X-ray image

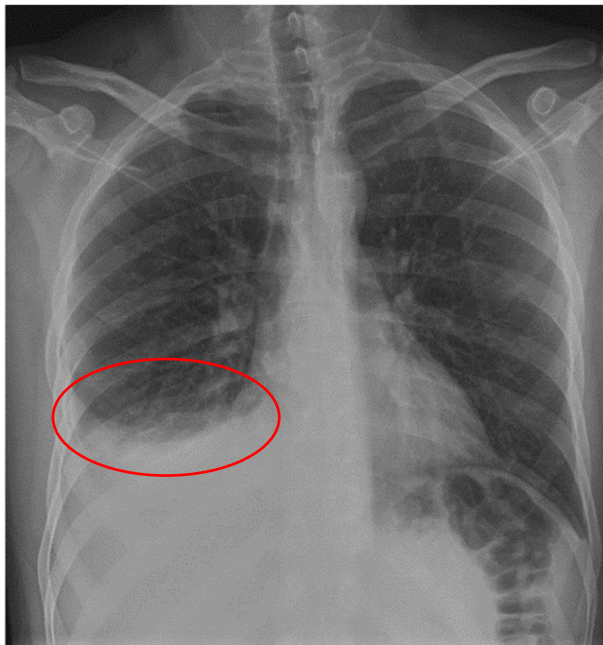


Figure 2.9: AOI on Pleural effusion X-ray image

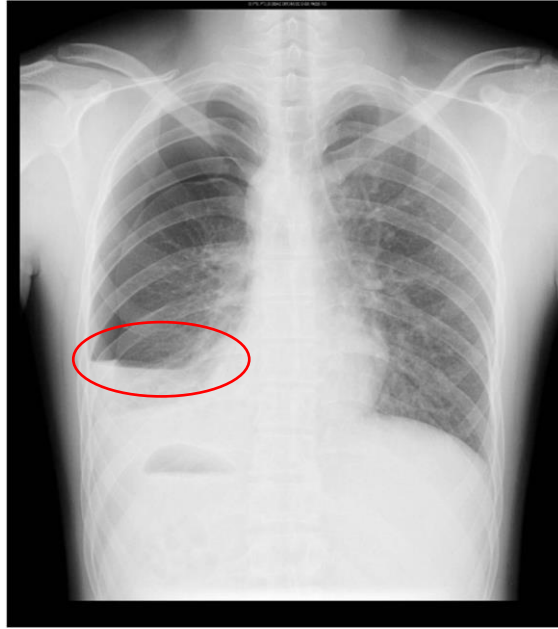


Figure 2.10: AOI on Pneumo-haemothorax X-ray image

2.2.5 Types of Diagnostic Errors

The 2015 paper “Enhancing Diagnosis in Healthcare” by the National Academies of Science, Engineering and Medicine outlines diagnostic errors as the inability to accurately diagnose a patient’s health conditions (Royce, Hayes & Schwartzstein, 2019). Radiographers are the main source of errors (Liaqat et al., 2021). Workplace disruptions can negatively impact radiographer performance, leading to errors and inadequate educational and training programs. (Liaqat et al., 2021). This study aims to identify and address diagnostic errors caused by inadequate training among radiographers by capturing expert eye movements and using them to train novices.

2.2.5.1 Observer error

Observer errors may result in interpreting normal anatomical structures as a pathology or failing to identify subtle abnormalities (Drew, Vo & Wolfe, 2013), leading to false-positive or false-negative readings (Delrue et al., 2011). In a false-positive reading, a discovery that does not mean

anything in pathology will be interpreted as an abnormality; in the event of a false-negative reading, an abnormality may be interpreted as normal (Delrue et al., 2011).

2.2.5.2 Cognitive error/Perceptual error

Perceptual errors lead to most misdiagnoses in medical imaging. These are errors in detecting abnormalities and can be caused by incorrect visual search and cognitive predisposition (Van der Gijp et al., 2017). The cognitive error can be associated with issues of visual perception, e.g. interpretation, recognition and scanning (Lee, Naggy, Weaver & Newman, 2013). Cognitive errors occurs when an imaging specialist fails to identify a pathology although they fixated on it for longer than required for recognition (Ludwig, Strnad, Bierhals & Mellnick., 2022). For example, when diagnosing a chest X-ray, an imaging specialist may miss a pathology (Lee, et. al., 2013).

Categories of perceptual errors (Delrue et al., 2011):

- Not noticing a lesion at all.
- Looking at the lesion for a long time but failing to recognise that it is a lesion.
- Looking at a lesion for a short time and failing to recognise it.

2.2.5.3 Search error/Scanning error

A failure to focus on a key area of a stimuli indicates a search error (Brunyé et al., 2019). A search error occurs when a specialist fails to fixate on a pathology. An expert's inability to concentrate on a diagnostically significant area of an X-ray image results in ineffective search, hindering recognition and decision-making. (Brunyé et al., 2019).

2.2.5.4 Recognition error/decision-making error

A recognition error or decision-making error is encountered when a participant fixated on a lesion but failed to successfully identify a pathology (Brunyé et al., 2019). This can happen when the participant fixates on a pathology only briefly, for less than the time required to recognise it.

2.2.6 Challenges with diagnostic errors

About 40 000 – 80 000 deaths that occur annually worldwide are due to diagnostic errors (Lee et al., 2013). The incorrect interpretation of X-ray images is defined as interpretative errors (Waite et al., 2017). Identifying the diverse chest pathologies is difficult for the human observer (Bar et al., 2015). Literature about radiological symptoms and signs to understand chest images is insufficient and scarce, often unavailable for young imaging professionals or too brief in textbooks (Delrue et al., 2011). Imaging professionals need consistent assessment methods and training to enhance their essential skills for efficient image interpretation (Bertram et al., 2016).

Failure to diagnose correctly leads to widely recognised issues causing medical malpractice lawsuits (Lee et al., 2013). Giving false-positive results and missing a pathology is every clinician's concern (Santia et al., 2013). Notwithstanding progress in imaging technologies, there is no proof of progress in the perceptual capacities of the human eye and brain (Lakshmanaprabu, Mohanty, Shankar, Arunkumar & Ramirez, 2019). Given this human limitation, several of the solutions developed to decrease interpretative errors are based on technology (Waite et al., 2017). Eye-tracking could be one of the technologies that can solve the above-mentioned human limitations.

A lesion is part of a tissue or an organ that has suffered harm through disease or an injury, for example a tumour, abscess, ulcer or wound (Rendon, Pizanis, Montanaro & Kraai, 2015). It is

difficult for imaging professionals to differentiate lung lesions from mediastinal structures, pulmonary vessels, bones and other complicated anatomical structures on chest X-rays (Del Ciello et al., 2017).

Chest X-ray image interpretation is crucial to detect thoracic diseases, inclusive of lung cancer and tuberculosis (TB), which influence thousands of people across the globe every year (Rajpurkar et al., 2018). Del Ciello et al., (2017) state that 90% of the errors in lung cancer diagnosis happen on chest X-rays. Lung cancer is a fatal disease with a poor prognosis if not diagnosed early (Hua et al., 2015). Those who are diagnosed with it have less than a 20% five-year survival rate (Hua et al., 2015).

2.3. Eye-tracking

2.3.1 Background

Through eye-tracking, a researcher can study attention processes and determine which areas were visited first, the order of visits and the duration of focus on each area. It can also determine how often attention shifts between different areas (Alemdag & Cagiltay, 2018). Studying eye movements can provide a trace of an individual's attention (Lai et al., 2013).

Remote eye-tracking involves the usage of a regular desktop computer with an infrared camera placed below the computer screen (Poole & Ball, 2006). Eye-trackers can precisely align an image with the movement of the eye by detecting infrared wavelengths that are reflected by a mirror (Klaib, Alsrehin, Melhem, Bashtawi, Magableh, 2021). Infrared eye-tracking provides great precision with little recalibration by measuring the distance between the glint and the centre of the pupil using near-infrared light reflected off the eye (Vos, Minor, Ramchand, 2022). On the contrary, visible light eye-tracking, such as WebGazer, depends on webcam images that are

converted into grayscale eye feature vectors for gaze prediction (Vos et al., 2022). Making visible light eye-tracking more susceptible to variations in illumination and head motions, which eventually reduces its accuracy (Vos et al., 2022). The video frames from eye-tracking are processed with software to find and determine eye features that can be used for tracking (Poole & Ball, 2006).

Eye-tracking technology offers an analytical tool for assessing visual patterns by capturing gaze direction and its relation to the AOI (Borg et al., 2018). Eye-tracking goes beyond studying eye movements (Harezlak & Kasprowski, 2018), as it can disclose different behaviours such as emotions, intention and the ability to apply skills and knowledge (Biggs & Mitroff, 2019). Eye-tracking may also be a valuable method for distinguishing novices from experts. (Borg et al., 2018). In comparison to novices, experts spend a short time identifying relevant AOIs and spend less time not looking at the relevant AOIs (Borg et al., 2018).

When conducting an ultrasound-guided caudal anaesthesia task, researchers hypothesised that novices could concentrate excessively on high brightness or high contrast areas within an X-ray image rather than on relevant areas. The research of Borg et al. (2018) backs this theory and showed that experts allocate limited time looking outside the relevant AOI compared to novices. Experts focus on diagnostically significant areas, while novices focus on eye-catching parts (Borg et al., 2018).

2.3.2 Fixations and saccades

Fixations and saccades are the two basic events that can be measured using eye-tracking (Alemdag & Cagiltay, 2018). *Fixation* refers to the eye's steady condition at a single point of regard, while

saccades refer to the rapid movements of gaze between fixations (Alemdag & Cagiltay, 2018). Saccades are the movements between consecutive fixations (Brunyé et al., 2019).

It is generally accepted that no visual information is processed during saccades (Venjakob & Mello-Thoms, 2016). Participants usually demonstrate a larger number of fixations while making tough judgements (Brunyé et al., 2019). The length of a saccade is referred to as its amplitude and is measured in degrees (Brunyé et al., 2019). Saccades vary in amplitude, from tiny movements done when reading to considerably bigger movements produced while looking around a room (Blignaut, van Rensburg & Oberholzer, 2019). Besides amplitude, saccades can also be described in terms of their peak velocity (Brunyé et al., 2019).

Fixations and saccades offer insights into how medical professionals interpret visual information, make judgments and move around their environment (Brunyé et al., 2019). Researchers can learn more about the complexities of human vision and decision-making by examining eye movements, which can also provide perception on perceptual and cognitive processes.

2.3.3 Heat maps and gaze plots

Visualisations can reveal aspects of saccades, fixations and gaze plot topologies and aid in analysing the spatiotemporal elements of eye-tracking data and understanding the data's complex relationships (Blascheck et al., 2014). *Spatiotemporal* refers to location (spatial) and time (temporal) dimensions. In this study, a gaze plot can be used to represent gaze patterns and a heat map can be used to visualize blind spot identification (Lee et al., 2022).

Heat maps are useful visualization tools that provide a summary of fixation patterns over many participants and aid in recognizing fixation hotspots (Klein & Ettinger, 2019). These spatial density plots illustrate the frequency of inspection for each region of an image, making it easy to measure

attention distribution (Klein & Ettinger, 2019). An alternate visualization method utilising the heat map tool provide additional advantages by distinguishing between the multiple levels of observational intensity (Špakov & Miniotas, 2007). Heat maps use colour coding, with red typically representing relatively high fixation numbers or duration, green representing the least, and yellow being in-between the highest and lowest (Bergstrom & Schall, 2014). Figure 2.11 below shows a heat map on a lung cancer X-ray image.

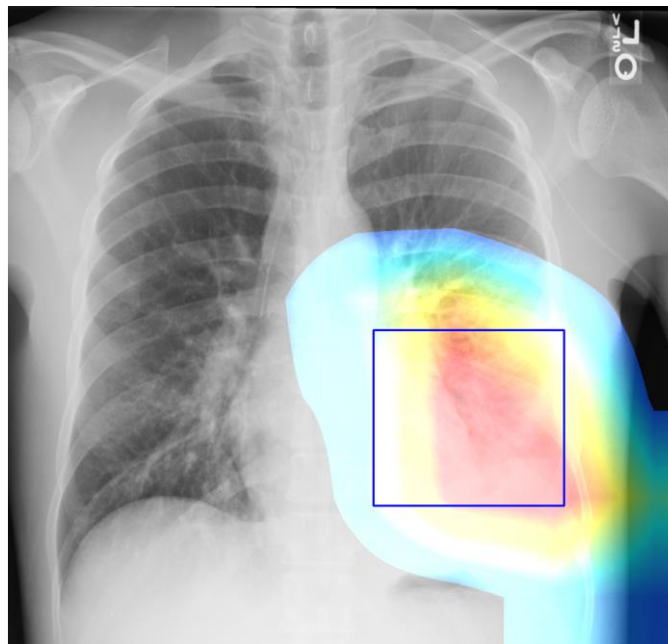


Figure 2.11: Heat maps on pneumonia X-ray image (Ravichandiran, Srivastava, & Chen, 2019).

Gaze plots connect successive fixations to the stimuli via saccade lines (Blascheck et al., 2014). In a gaze plot visualization, each fixation is represented by a circle, the radius of which is proportional to the duration of the fixation (Blascheck et al., 2014). Saccades between the fixations are connected by lines (Blascheck et al., 2014). Gaze plots provide insights into the areas of the stimuli that draw participants' attention, presenting this information in a logical order (Bergstrom & Schall, 2014; Blascheck et al., 2014). Figure 2.12 below shows a gaze plot on a chest X-ray image.

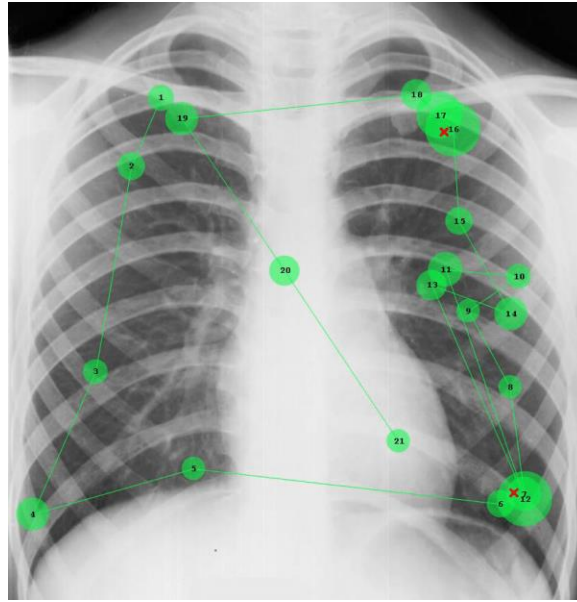


Figure 2.12: Gaze plot example on a chest X-ray image (Pietrzyk, Manning, Dix & Donovan, 2008)

Heat maps and gaze plots are useful for understanding which parts of the image participants concentrated on and can efficiently summarise this information. These features are available on the eye-tracking software Tobii pro (Tobii Studio User's Manual Version 3.3.2., 2015). They are used for data analysis after the participants have observed and examined the X-ray image. In the study, the gaze plots and the heat maps will be used to train novice radiographers when analysing chest X-rays.

2.4. Applications of eye-tracking in medical imaging

For decades, eye-tracking has proven to be a helpful tool for evaluating visual diagnostic methods in medical imaging (Van der Gijp et al., 2017). It has been widely employed in medical imaging for education, perceptual understanding and fatigue evaluation (Karargyris et al., 2021). The major goal of medical imaging research is to investigate imaging professionals' cognitive processes, visual search and perception processes (Venjakob & Mello-Thoms, 2016). Eye-tracking can be used in X-ray analysis for similar reasons since X-rays are a type of medical imaging.

Research in medical imaging shows that medical professionals disagree frequently with each other's diagnoses and with their prior judgements when they analyse the same images again (Lalumera, Fanti & Boniolo, 2021). This demonstrates how human judgements and visual assessments can be inaccurate and could be overwhelming for novices when analysing the images. This can be prevented by improving medical training. Eye-tracking can be used to train novices when analysing the chest X-ray images.

Eye-tracking is widely employed to reduce diagnostic errors, increase diagnostic accuracy and improve patients' well-being (Brunyé et al., 2019). Eye-tracking data reveals details about a patient's condition and demonstrates how an expert focuses on the relevant areas of an image when analysing a chest X-ray image (Karargyris et al., 2021). Eye-tracking can be useful for determining whether the examined areas are not only glanced at, but also diagnosed and perceived (Vogel & Schulze, 2021). Eye-tracking visualisation tools such as heat maps and gaze plots can display examined areas.

Krupinski (2006) (as cited in Helle, 2017) stated that eye-tracking could be effective for establishing eye movement patterns and evaluating the performance differences between novices and experts. Medical imaging research has grown from the use of eye-tracking technology to discover the tactics employed by experts to analyse radiographs effectively and efficiently (Arthur & Sun, 2022). They can also be beneficial in designing innovative visual search techniques (Helle, 2017). Eye-tracking can record the eye movements of the imaging technician, allowing for a comparison between the novices and the expert's patterns when analysing the X-ray images. Since the eye movements are recorded, imaging technicians can analyse their previous eye patterns and movements, and plan on how to enhance them in the future. Additionally, novices can learn from experts' captured eye movements.

2.5. Eye-tracking with radiography

Researchers can identify which areas of the stimuli were attractive to the participant and how the area was seen by that individual by making use of eye-tracking technology (Alemdag & Cagiltay, 2018). Chest X-rays provide rich and comprehensive information about a patient's condition to experts, yet they are widely known to be intimidating to novices (Quen et al., 2021). Understanding the perceptual process allows imaging specialists to develop search tactics that enhance clinician performance and include them in medical imaging education (Van der Gijp et al., 2017). For novices, analysing X-ray images might be a challenging task, but it becomes easy when novices view the eye movements of experts recorded using eye-tracking technology.

Eye-tracking measures the motions of the eye and gaze point to conclude which parts of an X-ray image are more important when making a medical decision (Fox & Faulkner-Jones, 2017). Rubin (2015) stated that there are four processes when inspecting a lung nodule during the interpretation of the chest radiograph. By tracing the gaze centre, the eye-tracker demonstrates the focal point of vision (Rubin et al., 2015). Research has shown that eye movements can be associated with the diagnostic decisions of the imaging specialist (Tourassi, Voisin, Paquit & Krupinski, 2013).

Lung nodule identification using eye-tracking during chest X-ray interpretation involves four detection process components, namely: decision making, search, orientation and recognition (Tourassi et al., 2013). Eye-tracking can reveal various strategies used by imaging specialists when examining the lungs (Rubin et al., 2015). In previous studies, eye-tracking technology has been used to evaluate the ability of the radiographer to diagnose lung nodules in chest images (McLaughlin et al., 2017). Eye-tracking has determined an understanding of cognitive techniques during the process of image interpretation (McLaughlin et al., 2017).

At the University of Pennsylvania, from the late 1970s to the 1990s, Harold Kundel and his colleagues led various experiments utilising eye-tracking to comprehend the reason for imaging specialists' recognition and detection of pulmonary lesions in chest radiographs (Rubin et al., 2015). This previous experiment focused on CT images rather than standard chest radiographs. However, in the current study, a comparable experiment was carried out using standard chest radiographs. Eye-tracking has been utilised to improve tumour recognition and give data on nodule misallocation (Antonelli & Yang, 2007).

Research on eye-tracking showed that experts look at the anatomical landmarks, while novices go through every single anatomical region in detail (Jarodzka et al., 2017). Experts reflect on perceptual processes and intellectual recall performance (Jarodzka et al., 2017). Imaging specialists depend on their skills to interpret images to diagnose and detect pathology in studies of medical imaging (Rubin, 2015). Interpreting X-rays is difficult because the information is rich and it can be a challenge to select the right information (Jarodzka et al., 2017). Experts find it easier to interpret X-ray images because they can recollect previous experiences, which allows them to know which areas to focus on.

Studies indicate that eye-tracking might be a useful technique used to reduce error-making during X-ray image interpretation, that is, decision-making, recognition and search (Brunyé et al., 2019). It is critical to discover visual search patterns that contribute to correct or incorrect interpretation of pathologies on radiological images (Van der Gijp et al., 2017). Although experts can rely on their previous performance, eye-tracking can be useful in capturing previous performances. This enables radiographers to analyse their previous actions and adjust their search patterns constantly.

While current eye-tracking metrics may not detect decision-making errors, some new research shows that somewhat chaotic eye movements across an image may signal decision uncertainty,

increased workload and a higher chance of errors (Brunyé et al., 2019). Figure 2.13 demonstrates a novice observer's disorganized eye movements. Their gaze was scattered, even outside the boundaries of the image, presumably showing ambiguity about where to concentrate their attention. Figure 2.14 below shows the gaze plots of an expert when examining a chest X-ray image.

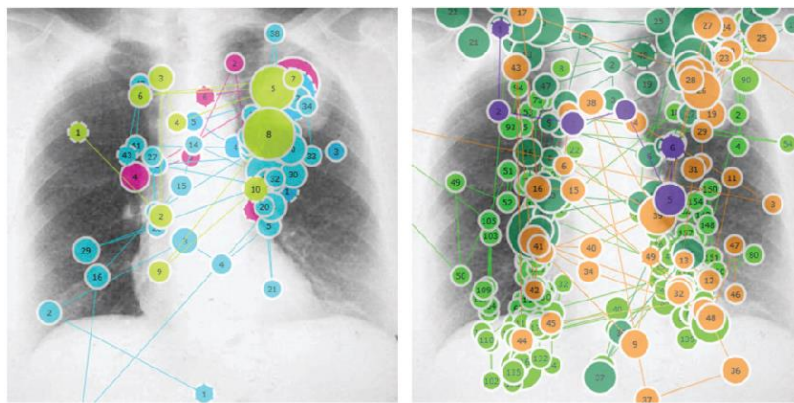


Figure 2.13: A novice's scattered gaze plots on chest X-ray images (Borys & Plechawska-Wójcik, 2017).

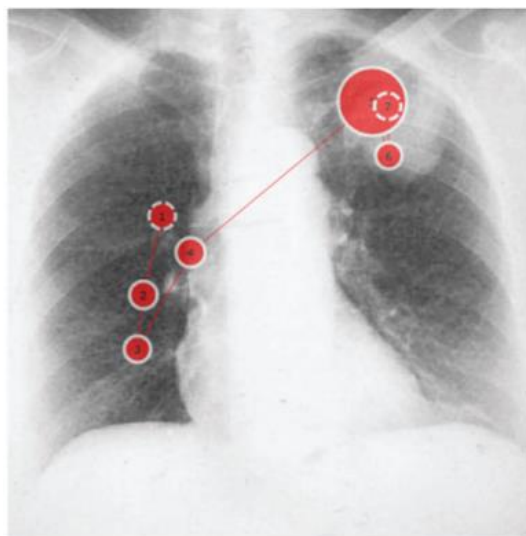


Figure 2.14: Experts gaze plots on chest X-ray images (Borys & Plechawska-Wójcik, 2017).

2.6. Eye-tracking for learning

Researchers in the educational field have discovered the broad range of eye-tracking applications in the research of learning challenges (Lai et al., 2013). Learning is the demonstration of obtaining or developing knowledge, behaviour or skills (Jarodzka et al., 2017). Imitation is an extremely effective method of learning tasks (Kok et al., 2015).

Experts are tasked to handle complex computer simulations such as 3D medical images, while novices learn from multiple sources like videos, and often they need to coordinate this information themselves (Jarodzka et al., 2017). Learning often occurs in environments with rich information, such as e-learning, textbooks and X-rays (Jarodzka et al., 2017), which can make learners easily overwhelmed by information. Eye-tracking provides important insights for enhancing teaching methods and generating more conducive learning environments (Donmez, 2023). Eye-tracking can help to understand developing learning and its guidance in education (Donmez, 2023).

Human beings acquire information through their eyes, for example, when executing a professional task and when learning (Jarodzka et al., 2017). Eye-tracking technology has the potential to transform medical education and clinical practice, providing a wide range of opportunities for creating advanced clinical training (Brunyé et al., 2019). Novices could observe experts' eye movements as they analyse an X-ray image.

Specialists in Educational Science explore the learning process to see how learning is established and how it can be encouraged through instruction (Jarodzka et al., 2017). In certain areas of surgery, nursing and sports, eye-tracking technology has been utilised for both assessment and training (Borg et al., 2018). Eye-tracking has become a critical instrument to examine processes

of learning (Jarodzka et al., 2017) and has been used for teaching and examination in medicine and other disciplines (Borg et al., 2018).

Radiographers primarily work on chest X-rays more often than they perform any other examinations, with chest X-rays being the first examination in radiography courses (Enfinger, 2015). Most healthcare professionals use methods like self-education and various guidelines to interpret an image (McLaughlin et al., 2018). However, eye-tracking has been utilised to understand the process of image interpretation and training (McLaughlin et al., 2018).

From a teaching perspective, the ultimate objective of eye-tracking studies on medical imaging is to enhance image analysis by reducing visual search errors (Van der Gijp et al., 2017). Wilson and colleagues have demonstrated that by observing an expert's gaze pattern during training, novices can be taught expert-like gaze patterns, which are defined by rapid gaze transitions and brief eye fixation (as cited in Borg et al., 2018).

Understanding where to direct your attention is important for success and this is acquired through one-on-one feedback from experts (Quen et al., 2021). However, individualised time is limited and teaching this ability is challenging since the teacher cannot immediately know where the student is looking to provide the most exact feedback (Quen et al., 2021). According to Quen et al. (2021), eye-tracking can monitor students' gaze movements allowing them to identify abnormalities during medical training. Although gaze patterns picked up by eye-tracking may not accurately reflect cognitive processes, Borg et al. (2018) suggest that they might assist lecturers in creating a specific cognitive process for the students. As a result, lecturers will have more insight into the students' fixation areas and will be more equipped to guide students on which areas to focus on during an X-ray analysis. Moreover, this can help lecturers during the evaluation process by enabling them to verify whether students fixated on the relevant areas or not.

Previous studies that used eye-tracking to analyse X-ray images have covered a wide range of research areas (Venjakob & Mello-Thoms, 2016). These studies have investigated Imaging specialists' cognitive processes, reading strategies, perceptual processes, how experts' and novices' gaze behaviours differ, and the potential for training novices' gaze patterns (Venjakob & Mello-Thoms, 2016). Eye-tracking holds tremendous promise as a method for measuring training progress toward the advancement of skills for visual-based and procedural activities (Borg et al., 2018).

2.7. Studies from other publications

The studies summarised below explore the incorporation of eye-tracking technologies in diverse medical contexts. These studies incorporate eye-tracking technology with other technologies, such as Virtual Reality (VR) and Artificial Intelligence (AI), all aiming to enhance imaging specialists' performance in X-ray analysis. Overall, the incorporation of eye-tracking technology in these investigations contributes to the advancement of medical research and education.

Harezlak and Kasproski's (2018) study explores the relationship between eye-tracking technology and how it relates to the performance and effectiveness of medical procedures. The study focuses on the use of eye-tracking technology in medicine, citing its wider applications such as therapy and medical education. Similarly, Lévêque et al. (2018) conducted an in-depth review of eye-tracking technologies role in medical imaging. Their study emphasises the ability to analyse visual search and recognition tasks in radiology, to improve radiological reading accuracy and speed. This supports Harezlak and Kasproski's findings, highlighting the importance of eye-tracking in both medical education and clinical practice.

Expanding on these themes, Quen et al. (2021) focused on the difficulties of interpreting chest X-rays, where errors may result in deaths which may be preventable. Their study indicated that eye-tracking can examine the gaze patterns of both experts and novices to identify areas for improvement during training. This is in alignment with the findings of Brunyé et al. (2019), who reported that gaze behaviours varied significantly between experts and novices, and that these variations can guide training strategies to improve radiographic decision-making.

While Quen et al. concentrated on perceptual challenges, Arthur and Sun (2022) explored the broader issue of radiological errors and the necessity for competency-based evaluations in medical education. They argued that eye-tracking could improve professional knowledge by providing information about gaze behavior during radiography analysis. Their findings complement those of Karargyris et al. (2021), who showed how eye-tracking data may be used with AI, particularly deep learning, to improve radiological interpretations. Karargyris et al. employed gaze-based data to train neural networks, providing a realistic illustration of how eye-tracking can combine human expertise with machine learning.

Furthermore, Moreira, Nobre, Sousa, Pereira and Jorge (2022) advanced technology integration by highlighting the potential of integrating eye-tracking with VR to overcome limitations in standard radiological settings. Their research proposed employing radiologists' eye-tracking data to create decision models that may help experts' performance. This approach is similar to the educational applications of eye-tracking described by Jarodzka et al. (2017), who found it helpful in improving testing conditions, increasing visual expertise, and enhancing skill development across disciplines such as medicine and chess.

In addition to technological integration, eye-tracking has educational benefits. Phillips et al. (2013) underlined its function in distinguishing between search and recognition errors, which provided

useful insights for teaching and training. Eye-tracking allows for targeted feedback to improve diagnostic skills by detecting if observers are directly fixated on a lesion. These findings are supported by Brunyé et al. (2019), who argued that eye-tracking has the potential to modify medical education and clinical practice.

Collectively, these studies show that eye-tracking can greatly improve radiography education. Novices can learn from expert gaze behaviours and build their own search patterns through observing and practicing. Furthermore, its applications go beyond radiography, providing insights into cognitive processes, advancing educational studies, and enhancing visual expertise. According to research such as Jarodzka et al. (2017) and Brunyé et al. (2019), eye-tracking has proven to be a useful and revolutionary tool in both educational and medical contexts.

In conclusion, the analysed studies indicates that eye-tracking technology has great potential in radiography and medical education. Novice radiographers can learn from expert gaze behaviours and build their own search patterns to increase diagnosis accuracy. These experiments, which combine eye-tracking with VR, AI, and other technologies, pave the way for novel approaches to medical education and practice.

2.8. Conclusion

This chapter proposes that there is a theoretical base for the current study, and it also gives an overview of previous research. The research and application of eye-tracking in radiography are illustrated. This chapter presents how eye-tracking has aided in learning and radiography in the past. The next chapter will cover the methods used to carry out the current study. The chapter thereafter will outline the procedures, data gathering process and data analysis process used to conduct this study.

Chapter 3 – Research method and design

3.1. Introduction

The previous chapter outlined other studies that are related to the current study. This chapter will focus on the methodological approach, data collection methods, data analysis methods and ethical procedures. The study aims to use eye-tracking technology to provide guidelines for teaching radiography students the correct elements to visit during chest X-ray analysis. Therefore, this chapter aims to ensure that the aim and the objectives of this study are met.

This chapter will outline the research design used, how the pilot study was conducted, the process of data collection, research tools used to conduct the study, calibration and data quality, compilation of stimuli, the process of data analysis and methods of data analysis.

3.2. Research design

For the current study, a pre-post experimental design was used along with a survey-based research design. A pre-post experimental design is an experiment in which data is obtained twice from the same group, before and after the treatment (Thiese, 2014). In this study, data will be obtained from the same students before and after the gaze behaviour of the experts was demonstrated to them.

Experimental designs are carried out to test a theory or hypothesis or to evaluate the effect of a specific intervention; Because of its excellent replicability, the experimental design research approach is often regarded as a classic research design when implemented appropriately (Hofstee, 2006).

A survey-based research design normally tries to obtain information from participants, and it can be an effective approach to learn about people's wants and attitudes (Hofstee, 2006). Survey-based

research, when correctly developed and performed, can provide answers to problems that no other research approach can (Artino, Durning & Sklar, 2018). However, participants often refuse to give information on sensitive issues, including illegal behaviours in the past; and they also tend to be biased when recalling previous events. Also, other memory constraints can make gathering and estimating correct replies challenging (Artino et. at., 2018).

A survey-based designs can be biased when it comes to cognitive processing and attention measures, like post hoc recall (Meernik et al., 2016). As a result, the experimental design was used. Experimental design that includes experiments and observational studies is commonly used for eye-tracking studies (Duchowski, 2007). Most experimental designs in medical education studies comprise two or three groups of participants at various levels of medical education (Fox & Faulkner-Jones, 2017). The current study also involves diverse groups of participants and various levels of training.

Figure 3.1 below summarises the sequence and the details of the assessment during the data gathering process. The first step was test 1 which was the pilot study, the second step was preparation, the third step was test 2 which was the pre-test, the fourth step was test 3 which involved capturing fourth year students' data, step five was the treatment, and the last step was post-test.

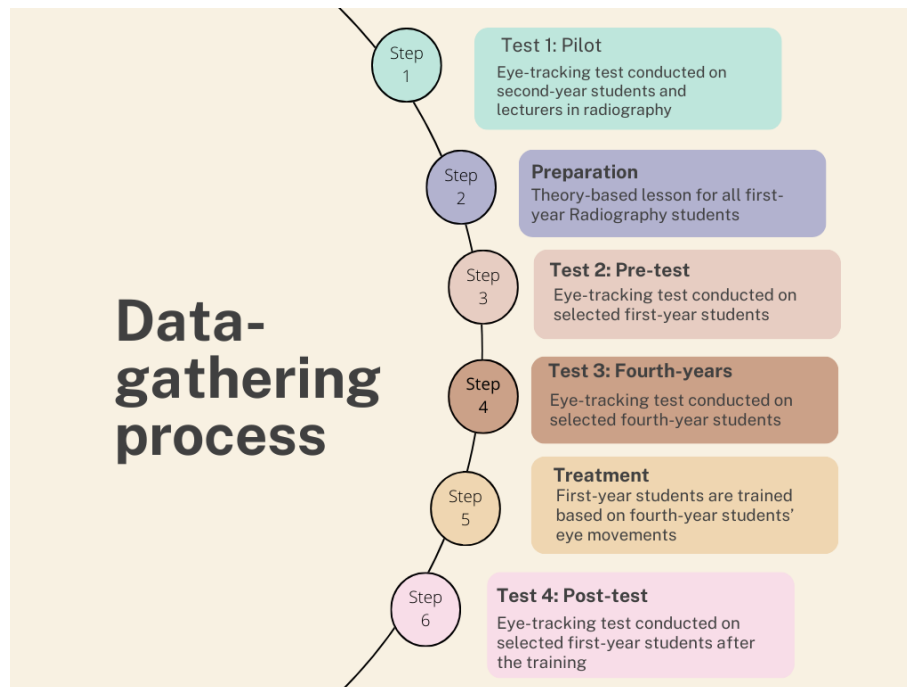


Figure 3.1: Sequence and details of data gathering

3.3. Methodology

3.3.1. Test 1: Pilot study

A pilot study was conducted to ensure that the most suitable stimuli were used for the study. The pilot study participants were randomly selected from the Department of Clinical Sciences (CS) at the Central University of Technology Free State (CUT), and they did not participate in the main study. Three staff members and two second-year students who were registered for the qualification, Bachelors of Radiography in Diagnostics, were part of the pilot study.

Existing hardware and eye-tracking equipment were used to capture the eye movements and gaze behaviour of the pilot study participants. The participants were given six chest X-ray images to analyse and identify pathology. See Appendix A for the six chest X-ray images that were provided

for the participants. The researcher recorded participants' answers as they examined the chest X-ray images.

The three staff members as well as the two students who took part in the pilot study also provided recommendations for improvements and assisted in choosing the suitable stimuli for the study. The staff members proposed that the researcher should find enlarged chest X-ray images with less contrast and brightness. However, the researcher could not find chest X-ray images with large pixels. The researcher therefore found an online application that enlarges the images, the enlarger tool is called ResizeFile (<https://resizefile.com/image-enlarger.html>). Some of the high contrast chest X-ray images showed more of the ribs than the lungs, so the staff members suggested a replacement of such images. Furthermore, the staff members advised the researcher to check the contrast of the images. Participants also suggested that the researcher should look for images with not more than one pathology and to look for correct exposures when finding the X-ray images.

Initially, the researcher did not set a time limit on the image slides and as a result, the participants dwelled too much on the image slide to the point where their eyes started wandering. Consequently, the researcher set the time limit to 15 seconds for each image slide.

The participants kept on forgetting the pathology options that they had to choose from, and the researcher had to keep reminding the participants of them. One of the participants suggested that the researcher can provide cards on the table to list the available options. Instead, the researcher decided to include a slide with options between the image slides.

Originally, the participants had six X-ray images to analyse and find a pathology. In the main study, 17 images with different pathologies were used. As a result, the informed consent forms and the information letters had to be amended to accommodate the changes after the pilot study.

Lastly, the researcher had challenges with the eye-tracking equipment during the pilot study. The researcher also noticed the need for two computer screens during data collection, as it was difficult to work with only one computer screen. The researcher and the participants needed two separate screens. The researcher managed the session through a software tool that should not distract the participant, and the participant should focus on the stimuli on the other screen.

3.3.2. Research Tools

Two computer monitors and eye-tracking equipment were used to capture the gaze behaviour of the participants during the pre-test and post-test. One monitor was used to display the chest X-ray images to the participants and the second monitor was used by the researcher to facilitate the process of data collection. The images were displayed on a Dell monitor, while the researcher used a Dell laptop as the second screen. Tobii Pro X3-120 screen-based eye-tracker was used to follow and capture the eye movements of the participants while they examine the chest X-ray images. Tobii pro version 3.4.8 software was used to record and analyse eye gaze data (Tobii Studio User's Manual Version 3.3.2., 2015). The Swedish business Tobii Technology AB, which specialises in eye-tracking devices, produced the Tobii Pro X3-120. This eye-tracker has since been discontinued by Tobii, but documentation can still be found here: https://connect.tobii.com/s/x3-downloads?language=en_US. This eye-tracker has a frame rate of 120 Hertz (Hz) and reported accuracy of 0.4° and precision of 0.24° under ideal circumstances (Tobii Studio User's Manual Version 3.3.2., 2015).

3.3.3. Data Collection

3.3.3.1 Research population and sample

Data was collected from forty-one first-year students from the Central University of Technology registered for the qualification: Bachelors of Radiography in Diagnostics and 23 fourth-year students registered for the same qualification. The first-year students were regarded as novices while the fourth-year students acted as the experts on the analysis of an X-ray image and identifying pathology on an X-ray image.

The researcher made a brief presentation about the study to the first-year students and the fourth-year students and only students who volunteered were part of the study. The first-year students and the fourth-year students were given consent forms to complete before taking part in the study.

3.3.3.2 Location/Environment

The eye-tracking procedure was done in a consultation room at the CS department at CUT, where only one participant was tested at a time to avoid disturbance. This was done in accordance with the requirement as stated by Jarodzka et al. (2017).

3.3.3.3 Orientation and Answering sheets

The participants were required to analyse chest X-ray images for pathologies. The students had to indicate if they saw any pathologies in the image. If they did observe a pathology, they had to specify the type of pathology present. The participants were given an orientation as to how the process will be conducted, and the researcher facilitated the data collection process. The participants were given questions, and the researcher recorded the answers on a paper-based answering sheet for each participant as they examined the chest X-ray images. An extract of the answer sheet is shown in Figure 3.2. The full answering sheet is provided in Appendix B.

Eye tracking Test		
Student Name:		Student Number:
X-ray Image No.	Did you see any abnormality?	If yes, what kind of abnormality did you see?
1	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
2	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea

Figure 3.2: Answering sheet example.

3.3.4 Data quality

This section explores the types of data quality. Accessibility, a suitable amount of data, correctness, completeness, trustworthiness, brief representation, ease of understanding, ease of manipulation, consistency, explainability, error-free, reliability, privacy, objectivity, usefulness and punctuality, are all qualities of data quality (Wuest, Tinscher, Porzel & Thoben, 2015).

The above data quality aspects were applied in the following manner:

To ensure consistency, the data gathering process was performed in the same venue in the Clinical Sciences Department lab at the Central University of Technology. The participants were presented with the same chest X-ray images, same exposure factors, same image quality and same computer monitor and size.

For correctness and accuracy of the data, during the recording process an eye-tracker captured data points of eye movement. Every data point is distinguished by x and y coordinates and a timestamp, and they are delivered to the database of the analysis program running in the background of the computer linked to the eye-tracker (Tobii Studio User's Manual Version 3.3.2., 2015). The

statistical data was reported by the Tobii Studio statistics tool. Precision and accuracy can be used to assess the spatial quality of the monitored gaze (Feit et al., 2017). Accuracy indicates the difference between actual gaze point and recorded gaze point, whereas precision assesses the variance between recorded gaze points during a fixation (Feit et al., 2017).

Tobii Studio's procedure for developing tests, recording them and analysing the data is illustrated in Figure 3.3 below:

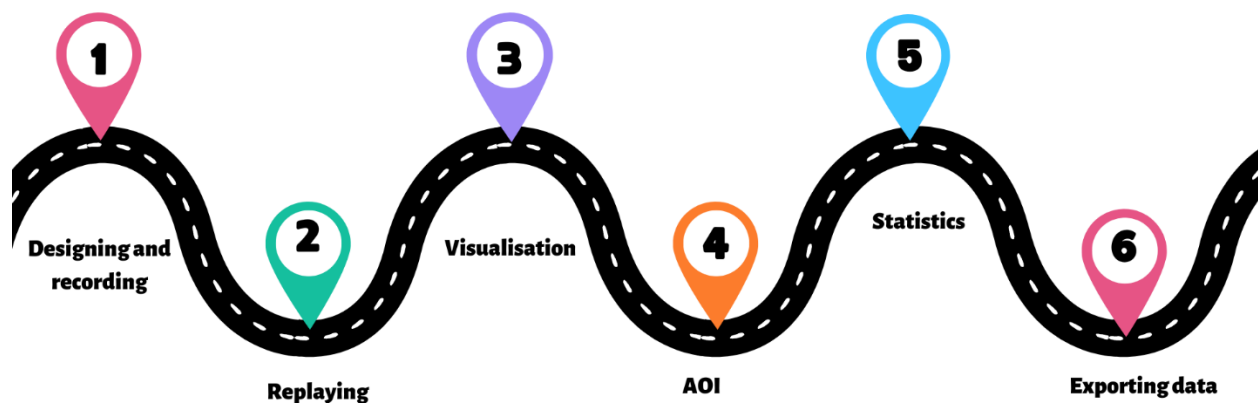


Figure 3.3: Tobii Studio's procedure (created by author)

3.3.5. Presentation of pre-training test

Forty-one first-year students, who are regarded as the novices in the current study were provided with preparation material based on chest X-ray pathologies to prepare for the eye-tracking test. This preparation material was theory-based, and the students were given a week to go through the material before being tested. The preparation material is attached as Appendix C. The preparation material provided was uploaded on eThuto – which is an online Blackboard portal of CUT via which students obtain crucial program information by logging into the university website, so that all the students who were part of the study may have had access to the lesson.

3.3.6 Test 2: Pre-training test

A week after the students went through the study material, eye-tracking equipment was used to capture the gaze behaviour of the novices. The novices were given 17 chest X-ray images to examine, fifteen images with pathology and two images without pathology. The 17 chest X-ray images are attached as Appendix A. Each student was given the same set of images in the same order, with no specific order assigned to the images. This test took an average of 10 minutes. Novices were presented with the following images:

- three images with Lung Cancer
- three images with Pneumonia
- three images with Pneumothorax
- three images with Pneumo-haemothorax
- three images with Pleural Effusion
- two images without pathology

The gaze behaviour of the novices was captured during the test, to check if they visited all correct elements and to check if they had identified the pathologies correctly. The AOIs are presented in Appendix D. The researcher recorded the answers of the novices as they examined the chest X-ray images.

The 17 images were selected based on the following criteria:

- correct positioning,
- correct image exposure,
- images without artefacts,
- required anatomy,

- pathology demonstrated.

The images were enlarged for ease of examination. As the X-ray images were taken from the internet, some of them had gridlines and letters on them. The artefacts present were removed from the images to minimise any distractions that would have shifted participants' attention from the important parts of the image.

The answers provided by the participants were then compared against their eye movements to ensure that they did not guess the correct answer. 1-tail t-tests were conducted to compare novices Time to First Fixation Mean values before and after training and fixation duration Mean values before and after training for each pathology.

3.3.7. Test 3: Capturing of fourth years' gaze behaviours

After data was collected for the first-year students, data were collected for the fourth-year students with the same stimuli of the pre-training test (Test 2). The gaze behaviour of the fourth-year students was captured. The same processes were followed again with the fourth-year students, except that the fourth-year students were not provided with preparation material before being tested, since they were regarded as the experts in this study.

3.3.8. Intervention and treatment

Intervention refers to treatments or methods to enhance outcomes and make a difference in the most key areas (Melnyk & Morrison-Beedy, 2012). Treatments are the distinguishing element of experimental research that distinguishes it from all other research methodologies (Bhattacharjee, 2012). The treatment for the current study involves a pre-post-test design, where first-year students were given a training based on fourth-year students' eye movements and gaze behaviours. The fourth-year students' heat maps as presented in Appendix E and gaze plots as presented in

Appendix F were used to train the first-year students. The slides that were used for training are shown in Appendix G.

After data was collected from the novices and the experts; the researcher analysed the experts' data to select the best gaze plots and a combined set of heat maps to train the novices. As shown below, a number of factors were carefully considered while choosing the experts' best gaze plots. The participants' ability to accurately identify the pathology was not the only criterion used in the selection procedure. Considering some participants were able to identify the pathology without focusing on the pathology. Rather than depending only on the final diagnostic result, a thorough evaluation method was used, considering several factors of visual search behaviour to make sure the chosen gaze plots reflected an efficient and methodical diagnostic approach.

The best gaze plots were selected based on the following criteria:

- Pathologies correctly identified,
- comparing both lungs during analysis,
- checking costophrenic angles,
- Time to First Fixation on the correct AOI and
- fixation duration on the correct AOI

The gaze plots indicated the correct elements to visit and how to correctly identify a pathology. Only one set of gaze plots were selected for each pathology. Different experts' gaze plots were selected, as there were no experts who got 100% on examining all the images and getting all the pathologies correct. Additionally, a collection of heat maps from all experts was used.

Heat maps, as indicated in Figure 3.4, and gaze plots were generated from these gaze behaviours, and they were used to show the areas where the density of fixations was the highest. Heat maps

utilise a colour scheme to show the total Duration of Fixations on various areas of a stimulus. Warm colours on the heat map, such as red and yellow, show areas which enjoyed the most visual attention. The gaze plots display the order, location and amount of time spent looking at different areas of the stimulus, as shown on Figure 3.5.

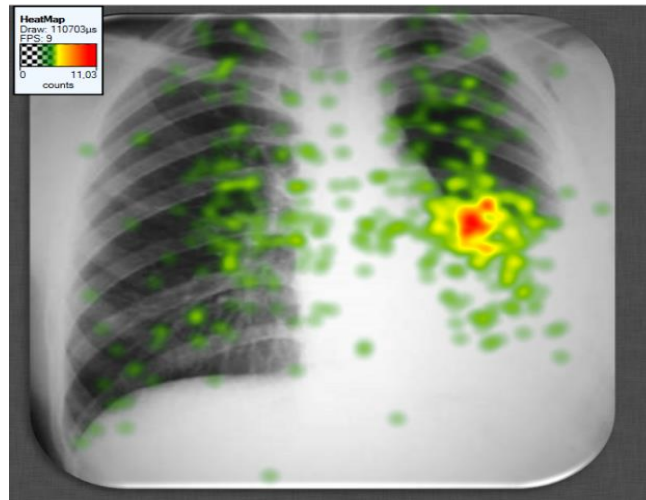


Figure 3.4: Heat map example

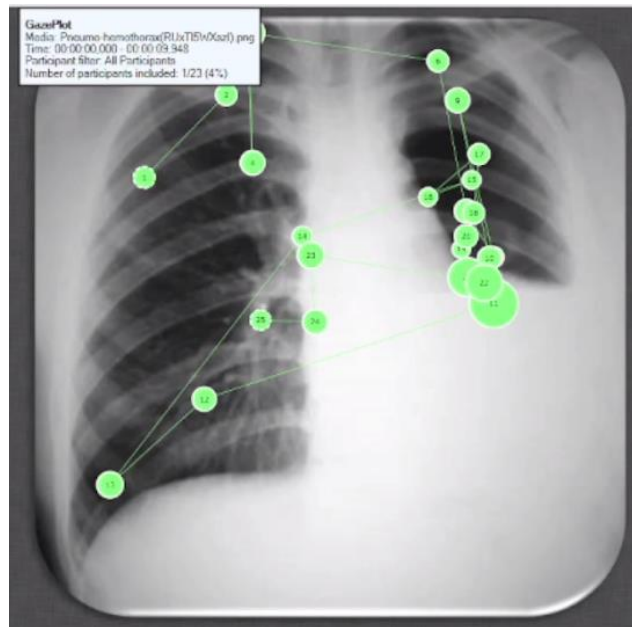


Figure 3.5: Gaze plot example

After the initial test, the novices were given training on how to examine an X-ray image and how to identify a pathology correctly based on the experts' gaze behaviour and eye movements that were selected. The novices were given one lesson based on the data that was collected from the experts' gaze behaviours. From the experts' gaze behaviour, 17 heat maps were generated and the heat map images were shown to the first-year students. (See Appendix E for experts' heat maps that were generated.) From the gaze plots that were generated, videos were created for all the X-ray images and these videos were shown to the novices. See Appendix F for the screenshot of the gaze plot videos from experts. These videos were generated from the best experts' eye movement and gaze behaviour as mentioned earlier in this Section. The best gaze behaviours were selected based on correct elements visited and correct identification of pathologies. The gaze behaviour of the experts also indicated to the novices where to fixate when examining the X-ray images.

3.3.9. Test 4: Presentation of post-training test

After the training, the novices were tested again with alternative but similar stimuli that were used during the pre-training. The post-training stimuli are presented in Appendix A. The gaze behaviours of the novices were captured again using eye-tracking technology. The same procedures as for the pre-training was followed. The post-training results are presented in Appendix H.

3.3.10. Calibration

Eye-trackers use an individual calibration technique where participants fixate on several targets at identified points (Barsingerhorn, Boonstra & Goossens, 2018). Prior to the eye-tracking recording, the researcher performed calibration with the participants to ensure the good quality of the eye gaze recordings. Participants had to fixate at five identified points on the screen to check the

calibration quality. During this process, the eye-tracking captures the eye characteristics of the participant and utilises them in conjunction with an internal 3D eye model to generate gaze data (Barsingerhorn et al., 2018). Figure 3.6 presents the beginning of the calibration process. Figure 3.7 presents good quality calibration, if the calibration was not of good quality as indicated in Figure 3.8, it had to be repeated.

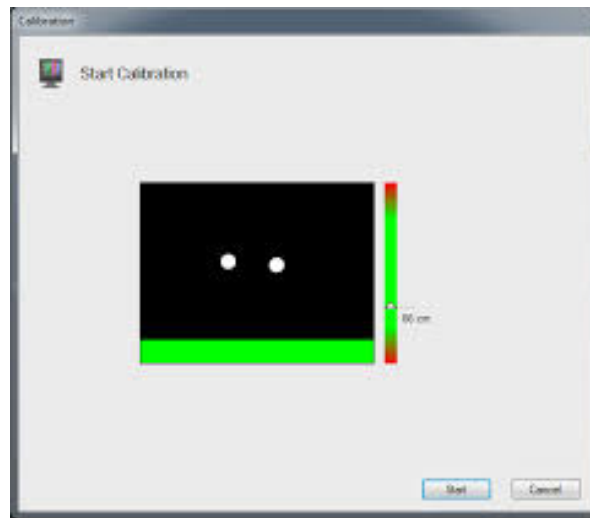


Figure 3.6: Calibration example



Figure 3.7: Example of good quality calibration

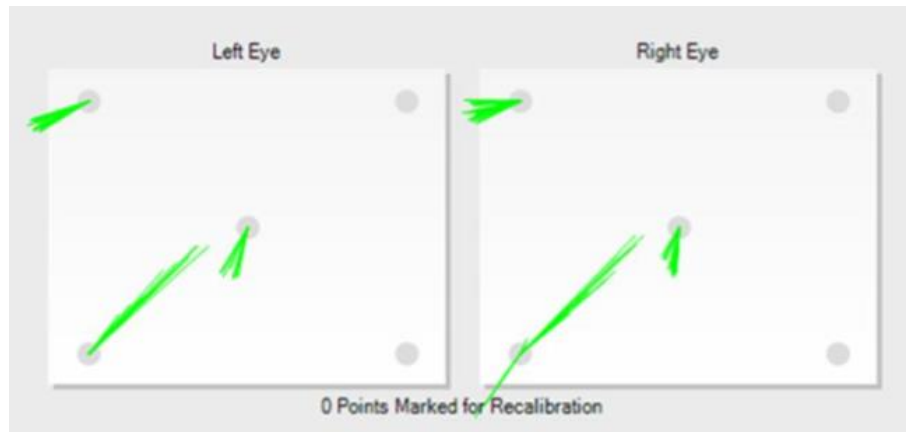


Figure 3.8: Example of bad quality calibration

3.4. Ethical procedures

For recruiting, the researcher did a brief presentation of the study for the participants for them to understand what is being asked of them. Moreover, the participants were given an information letter that outlined a brief overview of the study. The information letter is attached as Appendix I. The participants voluntarily took part in the study. The students who volunteered to partake in the study were given the informed consent forms to complete before participating. The informed consent form is attached as Appendix J.

The study did not disclose the names of the participants, ensuring participants' anonymity was protected as necessary in the study. Participation was voluntary, and participants could withdraw at any time, without consequences. Furthermore, no incentives or rewards were offered for participating in the study.

The data collection sessions were scheduled outside academic hours, and the participants had the flexibility to re-schedule to the time that was suitable for them and the time that would fit into their academic routines. The data collection process averaged for 10 minutes, ensuring that it did not interfere with the participants' academic work.

The researcher explained the purpose of the study to the participants and the participants were given a chance to ask questions where they did not understand. Participants were given the assurance that their personal details will not be mentioned in the dissertation. Only one participant was tested at a time to ensure privacy measures. The participants who later wanted to withdraw from the study were allowed to do so. The ethical clearance was granted by the Health Science Research Ethics Committee (HSREC) from the University of the Free State (UFS). The protocol number is UFS-HSD2020/1578. The ethical clearance is attached as Appendix K. The study was done at UFS because all studies on and with radiographers as Allied Health workers must have ethical clearance from the HSREC and only at UFS.

Tobii Eye-tracking devices detect and monitor eye movements using infrared light (Tobii Technology, n.d). This device does not come in contact with the eyes, making it safe for regular use. The infrared light utilised is low-intensity and within safe exposure levels (Tobii Technology, n.d). This infrared light is similar to the infrared light found in TV remotes or face recognition on smartphones and poses no harm to the eyes. Eye-tracking software solely records patterns of eye movements and does not collect any sensitive biometric or medical data (Holmqvist, Nyström, & Mulvey, 2012) beyond the study's scope.

3.5. Limitations

The sample size was relatively small. A total of 26 fourth-year students initially volunteered to participate in the study; however, three students withdrew from the study. The withdrawal was due to distance learning, as they were out of town during the data collection time, which took place during the Covid-19 lockdown, preventing some students from going to campus. A total of forty-one first-year students volunteered to participate in the study, however, one student did not attend

the training, therefore, data could not be collected from him during post-training data collection phase. Furthermore, most students were not available due to distance learning and there was not enough time for data collection.

3.6. Conclusion

This chapter discussed the methods, collection and analysis approaches that were used for the current study. It includes participants' information, such as the inclusion criteria for the research, who the participants were and how the participants were sampled. It outlines the research designs that were used and why they were used for the purpose of the study. The equipment utilised for data collection is also detailed. Finally, the ethical considerations that were addressed during the process were also examined. The next chapter discusses the findings that were discovered during the data collection and data analysis process.

Chapter 4 – Presentation and Analysis of Data

4.1 Introduction

The previous chapter focused on methodological concepts, data-gathering methods, data analysis methods and ethical procedures. This chapter focuses on data analysis and data presentation. Furthermore, it presents the data analysis and results summary. The gathered data per Section 3.3.3 and the results will be analysed in this chapter. The hypotheses listed in Section 1.4 and the objectives presented in Section 1.3.3 will be tested based on the findings. The findings will be analysed and interpreted.

The data acquired were analysed per the research question presented in Section 1.3.2. Novices analysed the chest X-ray images to collect and observe their gaze behaviour. The goal was to analyse their gaze behaviour before and after observing expert gaze behaviour to see whether there were any differences. Furthermore, data was collected to report on trends and strategies that novice radiographers use to analyse a chest X-ray image and provide guidelines to radiography lecturers on how the use of eye-tracking technology can benefit radiography students during training. To train the novices, lecturers can make use of experts' gaze plots, eye movements and the pre-recorded videos, in addition to eye-tracking technology. Although pre-recorded materials can be used for teaching and provide insightful information about expert gaze behaviour, using real-time eye-tracking technology offers extra advantages like performance evaluation, adaptive learning opportunities, and individualized feedback.

4.2 Data analysis

4.2.1 Procedure

Statistical analysis was carried out to analyse the eye movements and gaze behaviour data of novices during chest X-ray analysis. Diagnostic analysis was used to report on possible trends and strategies that novice radiographers used to critique an X-ray image. Data were analysed using the Tobii Studio Statistics tool. The data from Tobii Studio Statistics tool was obtained from eye-tracking data collected using Tobii eye-tracker. The Mean values from Tobii Studio Statistics tool were then exported to Microsoft (MS) Excel, where the MS Excel data analysis tools were used to analyse the data. Chi-square and 1-tail t-tests the MS Excel data analysis tools used to examine the statistical significance of relationships between novices' pre- and post-training gaze behaviours concerning the hypotheses listed in Section 1.4. The threshold of significance was fixed at 0.05.

The Statistics tool in Tobii studio generates calculations and shows descriptive statistics for the mouse tracking metrics and the eye (Tobii Studio User's Manual Version 3.3.2, 2015). The calculations generated by these metrics are based on the time frames of data selection and AOIs specified by the researcher.

Chi-square test was used to determine if there is a significant difference between the observed data and the expected data (Ali & Bhaskar, 2016). The current study used Chi-square test to determine if there is a significant difference between novices' pre-training and post-training gaze behaviour data when analysing the chest X-ray images for pathology. Fischer's exact test was used in place of the Chi-square where the observations and the expected frequency in each cell was less than five. Chi-square was used to analyse data based on the following criteria: Comparing both lungs (CBL), checking costophrenic angles (CCA) and identifying the correct answer (CA).

The 1-tail t-test was to test the null hypothesis, specifically to test whether there is a significant difference between the novices' pre-training data and the post-training data. The experiment was conducted to test the null-hypotheses listed in Section 1.4. 1-tail t-tests were used to analyse data based on the following criteria: Time to First Fixation (T2FF) and the Duration of Fixation (DoF) on the pathology if present.

In terms of identifying correct answer, participants had to examine the chest X-ray images and identify the type of pathology that were present on that chest X-ray image. The assessment evaluates participants' diagnostic ability in accurately identifying chest X-ray pathology. Additionally, the researcher recorded the participants' answers on a paper-based answer sheet as shown in Figure 3.2. The current study focused only on five different pathologies, namely: Lung Cancer, Pneumonia, Pneumothorax, Pneumo-haemothorax and Pleural Effusion, and there were also images without pathology.

The participants were required to compare both lungs, and while comparing, they were also required to check the costophrenic angles when analysing the chest X-ray images. The measurement being evaluated is their ability to successfully compare the lungs, which requires them to gaze at both lungs. Furthermore, they had to fixate on both costophrenic angles. Their ability to analyse costophrenic angles for abnormalities is being evaluated, including identifying pathology on the costophrenic angles, requiring both lungs' costophrenic angles to be gazed at. The gaze plots assisted the researcher to confirm that the participants gazed at both costophrenic angles.

The other criteria that were checked during analysis is Time to First Fixation, which is the time it takes for the participant to fixate on the AOI for the first time after the stimulus is displayed. Participants had to focus on the AOI to identify pathologies. This metric indicates how long it took

the participant to fixate on the AOI for the first time after the stimuli were displayed. Furthermore, Fixation Duration on the AOI was analysed, which is an individual's fixation duration within the AOI. This metric indicates how long each fixation lasted within the AOI. Eye-tracking was used to measure the time the participants took to observe the pathology for the first time and the duration of looking at the pathology.

The purpose of data analysis was to identify, define and investigate the relationship between novices' pre-training and post-training results. Appendix L contains the results of the data collected during the novice's pre-training eye-tracking test. Appendix H contains the results of the data collected during the novices' post-training test. The gathered data will be presented in the following manner:

- Novice pre-training gaze behaviour data were compared and analysed against novice post-training gaze behaviour. This was to evaluate if the novice's performance improved after the training. The results are presented in Section 4.2.2.
- Data was analysed based on the hypotheses in Section 1.4

The data analysis process was conducted by the researcher with the support from the supervisors.

4.2.2 Results

Novice gaze behaviour data that was captured before the training were analysed and compared against their gaze behaviour data after the training data to determine whether the gaze behaviour of the experts had an influence on the novices' gaze behaviour when analysing the chest X-ray images; and to check whether there was an improvement in how the novices analysed an X-ray image and identify pathology. The study would then provide guidelines that use eye-tracking

technology to teach radiography students the correct elements to visit when analysing a chest X-ray image for pathologies.

The pre-training results are presented in Appendix L and the post-training results are presented in Appendix H. The chi-square and the t-test results are presented in Appendix M and Appendix N respectively. Appendix M represents the chi-square results of novice's pre-training and post-training while Appendix N represents the 1 tail t-test results of the two tests.

Hypotheses

The study was conducted to test the following hypotheses. "Training" in this context refers to students watching the gaze patterns of expert radiographers when analysing different chest X-ray images.

H_{0,1}: There is no difference in the ability of first year students to compare the two lungs in an chest X-ray image before and after training. Students are required to inspect both lungs when analysing chest X-ray image. The measurement being evaluated is their ability to successfully compare the two lungs, which requires them to gaze at both lungs.

H_{0,2}: There is no difference in the ability of first year students to check costophrenic angles in a chest X-ray image before and after training. The students are required to check costophrenic angles for any abnormalities to determine the type of pathologies present. Students must assess the complete visualisation of costophrenic angles. Their ability to analyse costophrenic angles for abnormalities is being evaluated, including identifying pathology on the costophrenic angles, requiring both lungs' costophrenic angles to be gazed at.

H_{0,3}: There is no difference in the ability of first year students to identify a pathology on a chest X-ray image before and after training. The students are required to analyse the chest X-ray images

and identify the pathology present on the image. The assessment evaluates students' diagnostic ability in accurately identifying chest X-ray pathology.

H_{0,4}: Time to First Fixation on the pathology in a chest X-ray image (if present) of first year students is not less after training than it was before training. Participants must focus on the correct AOI to identify pathologies. The metric of Time to First Fixation indicates how long it took the participant to fixate on the correct AOI for the first time after the stimuli were displayed.

H_{0,5}: Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training. This metric indicates how long each fixation lasted within the AOI that covers the pathology.

Table 4.1 below is a breakdown of how each novice participant performed when analysing the Pneumo-haemothorax X-ray image, based on the novices' results presented in Appendix L. The table displays the hypothesis statements (hypothesis listed above) as well as the number of participants who successfully analysed the X-ray image correctly and participants who did not analyse the X-ray image correctly for each criterion. The table presents the number of participants who successfully checked both lungs, checked Costophrenic angles and accurately identified the pathology, before training.

Table 4.1: Breakdown of how each novice participant performed before training when analysing the Pneumo-haemothorax X-ray image.

Hypothesis	Successful	Unsuccessful
	Participants	Participants
H_{0,1}: CBL	29	12
H_{0,2}: CCA	8	33
H_{0,3}: CA	5	36

Legend: CBL = Check both Lungs, CCA = Check Costophrenic Angles, CA = Correct Answer

A total of forty-one first-year students volunteered to participate in the study, however, one student did not attend the training, therefore, data could not be collected from the participant during post-training data collection phase. Based on the novices' post-training results presented in Appendix H, below is a breakdown of how each participant performed when analysing the Pneumo-haemothorax X-ray image. Table 4.2 below presents the number of participants who successfully checked both lungs, checked Costophrenic angles and accurately identified the pathology, after training.

Table 4.2: Breakdown of how each novice participant performed post-training when analysing the Pneumo-haemothorax X-ray image.

Hypothesis	Successful participants	Unsuccessful participants
H_{0,1}: CBL	40	0
H_{0,2}: CCA	16	24
H_{0,3}: CA	31	9

Legend: CBL = Check both Lungs, CCA = Check Costophrenic Angles, CA = Correct Answer

The novices' pre-training and novices' post-training results above were analysed using chi-square. The results are documented in Appendix M. The hypotheses presented in Section 1.4 were evaluated and the novices' pre-training results were compared with the novices' post-training results in terms of analysing the chest X-ray and identifying pathologies. The hypotheses, data observed, chi-square test outcomes and conclusions are presented in Table 4.3 below. The conclusions on Table are based on p-values after comparing the pre- and post-training data.

Table 4.3: Novices' pre-training and post-training chi-square results and conclusions when analysing Pneumo-haemothorax X-ray image.

Hypothesis	Pre- training (Success)	Pre- training (Failure)	Post- training (Success)	Post- training (Failure)	p-value	Chi- square statistic	Conclusion
H_{0,1}: CBL	29	12	40	0	<0.000	13.743	Significant difference
H_{0,2}: CCA	8	33	16	24	0.043	4.075	Significant difference
H_{0,3}: CA	5	36	31	9	<0.000	34.970	Significant difference

Legend: CBL = Check both Lungs, CCA = Check Costophrenic Angles, CA = Correct Answer

Table 4.4 below summarises chi-square and 1-tail t-test results obtained from the novices' pre-training results and post-training results for each image based on five criteria outlined in Section 3.3.6. The full results are presented in Appendix L and Appendix H, and the full analysis is presented in Appendix M and Appendix N. In the Table below, Y represents instances where the

difference is significant, therefore the null hypotheses recorded in Section 1.4 cannot be rejected ($p < .05$).

Table 4.4: Significance of differences between novices pre-training and post-training with respect to various aspects of selected images. Significant differences are indicated with 'Y'. Non-significant differences are unmarked. Non-applicable entries are marked with '-'.

Image	Time to First Fixation on the pathology	Duration of Fixation on pathology	Compare both lungs	Check costophrenic angles	Correct answer
Image 1_Lung Cancer			Y	Y	Y
Image 11_Lung Cancer				Y	Y
Image 17_Lung Cancer	Y	Y	Y	Y	Y
Image 2_Pneumonia_Ellipse & Left		Y		Y	
Image 2_Pneumonia_Ellipse 2 & Right	Y	Y	-	-	-
Image 7_Pneumonia_Ellipse 3 &left	Y				
Image 7_Pneumonia_Ellipse & Right	Y	Y	-	-	-
Image 12_Pneumonia		Y		Y	

Image	Time to First Fixation on the pathology	Duration of Fixation on pathology	Compare both lungs	Check costophrenic angles	Correct answer
Image 4_Pneumo- haemothorax					Y
Image 14_Pneumo- haemothorax	Y				Y
Image 16_Pneumo- haemothorax	Y	Y	Y	Y	Y
Image 5_Pleural Effusion	Y			Y	Y
Image 10_Pleural Effusion	N	Y	Y	Y	Y
Image 13_Pleural Effusion	Y	Y		Y	Y
Image 6_Pneumothorax	Y		Y		Y
Image 9_Pneumothorax	Y	Y		Y	Y
Image 15_Pneumothorax	Y	Y		Y	Y
Image 3_Normal Image	-	-		Y	
Image 8_Normal Image	-	-	Y	Y	
Y	11	10	6	13	12
% for Y	65%	59%	35%	76%	71%

The results summary table presented in Table 4.4 above summarises the chi-square and the 1-tail t-test of each image based on the five criteria outlined in Section 3.3.6. Two columns at the end of the table illustrate the percentage of Y and N responses for each criterion for all the images. The analysis below is based on those percentages. The following conclusions were reached:

- Concerning Hypothesis $H_{0,1}$ in Section 1.4, there are significant differences concerning the comparison of lungs between the novice pre-training and novice post-training gaze behaviour for 35% of the images.
- Concerning Hypothesis $H_{0,2}$ in Section 1.4, there are significant differences concerning checking costophrenic angles between the novice pre-training and novice post-training gaze behaviour for 76% of the images.
- Concerning Hypothesis $H_{0,3}$ in Section 1.4, there are significant differences concerning the correct answer between the novice pre-training and novice post-training gaze behaviour for 71% of the images.
- Concerning Hypothesis $H_{0,4}$ in Section 1.4, there are significant differences between the Time to First Fixation on a pathology between novice pre-training and novice post-training gaze behaviour for 65% of the images.
- Concerning Hypothesis $H_{0,5}$ in Section 1.4, there are significant differences between the Duration of Fixation on the pathology of the novice pre-training and novice post-training gaze behaviour for 59% of the images.

Table 4.5 below summarises the Chi-square and 1-tail t-test results presented in Table 4.4 and the paragraph above. The results are related to hypotheses $H_{0,1}$ to $H_{0,5}$ concerning different criteria outlined in Section 3.3.6. It represents the hypotheses and the percentage of chest X-ray images that demonstrated significant differences and those that did not.

Table 4.5: Novice pre-training and post-training chi-square and 1-tail t-test results summary based on the five criteria outlined in Section 3.3.6

Hypothesis	Percentage of images with significant differences	Percentage of images with no significant differences
H_{0,1}: CBL	35%	65%
H_{0,2}: CCA	76%	24%
H_{0,3}: CA	71%	29%
H_{0,4}: T2FF	65%	35%
H_{0,5}: DoF	59%	41%

Legend: CBL = Check both Lungs, CCA = Check Costophrenic Angles, CA = Correct Answer, T2FF = Time-to-First-Fixation, DoF = Duration of Fixation

Figure 4.1 below presents the summary of the results that are shown above. It presents a summary of the outcomes of evaluating the hypothesis on various image criteria. The figure displays the image percentage with a significant difference ($p < .05$) and the image percentage with no significant difference ($p > .05$) for each criterion. In the figure below, Y represents $p < .05$ and N represents $p \geq .05$.

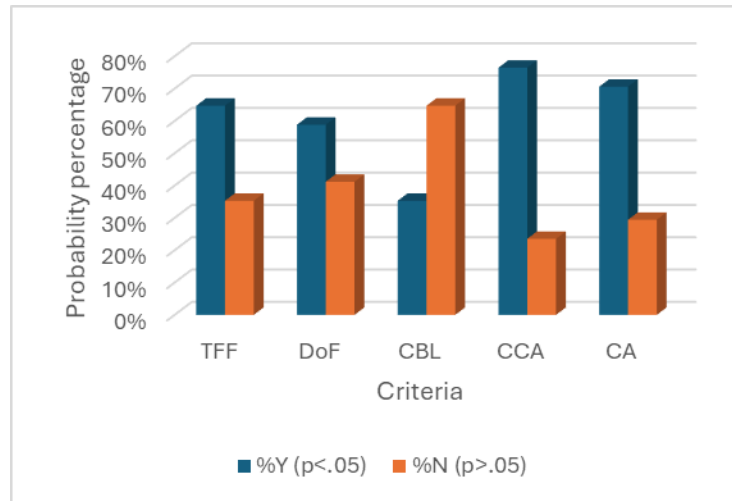


Figure 4.1: Percentage of images for which the null-hypothesis can be rejected per criterion and participant group based on novice pre-training gaze behaviour when compared with their post-training gaze behaviour.

Based on Figure 4.1, Table 4.2 and Table 4.3, the novice results improved after the training. The results revealed that there is a significant difference in the gaze behaviour of novice radiographers for most of the images before and after the training. The novice radiographers performed better after the training. Therefore, the research objectives outlined in Section 1.3.3 were addressed.

4.2.2.1 Visualisation

Novices pre-training, and novices post-training heat maps were analysed. Heat maps highlighted areas of interest by providing an aggregated representation of the areas where participants most frequently concentrated. Forty-one participants pre-training novice heat maps showed a scattered pattern of fixations with less attention paid to important anatomical regions. The post-training heat maps, which included 40 participants, on the other hand, showed a more focused and organised attention that was in alignment with expert patterns.

Novices pre-training heat maps revealed the following key patterns:

For lung cancer chest X-ray images, fixations were not focused on the AOI; rather, they were scattered throughout the lung fields. Similarly, for pneumo-haemothorax chest X-ray images, novices displayed scattered fixations and lacked a clear focus on significant areas. In case of pneumonia chest X-ray images, a lack of experience in recognizing abnormalities associated to pneumonia was evident from the dispersed visual attention. Likewise, for pleural effusion chest X-ray images, novices focused on periphery, perhaps as a result of the inability to accurately identify pleural effusions.

Novices post-training heat maps revealed notable improvements:

After training, participants showed a more concentrated gaze on abnormal areas of lung cancer X-ray images, indicating an improvement in their diagnostic techniques. In the same way, their fixations on X-ray images of pneumonia become more focused on the lung fields, which are where pneumonia is frequently observed. When it came to X-ray images of pleural effusions, participants' identification of pleural effusions was better than it was before to training. Similarly, a higher density of fixations was seen in the crucial areas of pneumothorax X-ray images, indicating improved attention to important locations.

After training, the heat maps revealed a more focus on significant anatomical structures, indicating better attentional allocation. These results align with previous research by Špakov & Miniotas (2007) and Klein & Ettinger (2019), which suggest that utilising heat maps provide additional advantages by distinguishing between the multiple levels of observational intensity and assisting in identifying fixation hotspots.

4.3 Results summary

The findings of Brunyé et al. (2019) show that novices focus on areas that are not of diagnostic value were confirmed. For example, Figure 4.2 shows an example of combined set of heat maps from novices, highlighting the areas of the chest X-ray image that is not of diagnostic importance when analysing chest X-ray images. The novices' heat maps are recorded in Appendix E. Figure 4.3 shows the precise area where the novices had to fixate in contrast to their fixations in shown in Figure 4.2.

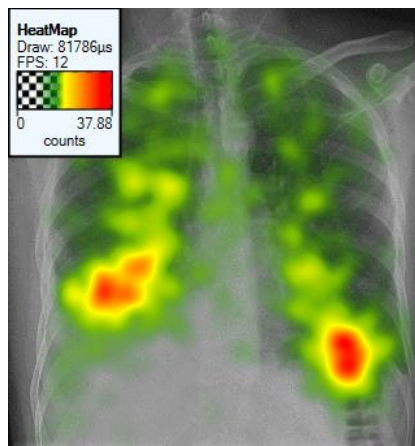


Figure 4.2: Novice heat map image on pleural effusion X-ray image

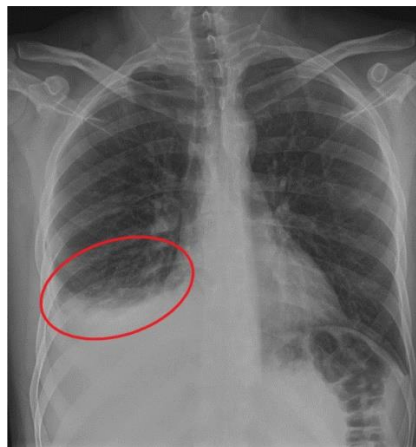


Figure 4.3: AOI on pleural effusion X-ray image

Results demonstrated that novices' pre-training gaze behaviour differed from novice post-training gaze behaviour, especially in identifying pathologies like lung cancer, pneumo-haemothorax, and pneumothorax. The novices showed improvements when analysing some of the images, they showed ability to concentrate on diagnostic areas of the X-ray image (Section 4.2.2).

Table 4.3 demonstrates that there is a significant difference between novices' pre-training and post-training when it comes to comparing both lungs, with the p-value of <0.000 . The results indicate that all the novices successfully compared both lungs when analysing pneumo-haemothorax X-ray image after-training. The table also shows significant differences between novices' pre-training and post-training when checking the costophrenic angles, with p-value of 0.043. Lastly, the novices show some improvement when identifying the pathology present, with the p-value of <0.000 . In conclusion, these results demonstrates that the training have significant outcomes on the three criteria (CBL, CCA, CA).

The findings show that expert gaze behaviours greatly improve novices' skills for analysing chest X-ray images, with improvements in pathology identification and methodical search patterns. These results offer insightful information to radiography lecturers and raise the possibility of more widespread use of eye-tracking technology in medical education.

Therefore, we can conclude that experts' gaze behaviour may influence the gaze behaviour of novices when analysing chest X-ray images. In previous studies where eye-tracking was used as a training tool, results indicated that there was an improvement in task performance (Tien et al., 2014). With these findings, lecturers will be able to notice students' trends when analysing chest X-ray images. Thus, the lecturers will be able to structure their guidance and give novices tips on what to do and what not to do when analysing chest X-ray images.

4.4 Conclusion

In this chapter, the analysis of the results and data analysis methods used were discussed. The findings were presented graphically and in a tabular format. The next chapter discusses the hypothesis and the research objectives. The teaching guideline are presented, and the novices' trends are highlighted. Additionally, the limitation of the study is acknowledged, and future research recommendations are suggested.

Chapter 5 – Conclusion

5.1 Introduction

The previous chapter presented the analysis of the gathered data and presented the findings. This chapter summarises what was discussed in the introduction chapter and discusses the discoveries in the study. It presents the summary of the findings, reflection of hypotheses, conclusion remarks, summary of contributions and recommendations for further research.

5.2 Relationship between the study's findings and previous studies

The study's findings are in alignment with previous studies that highlight how gaze training can increase diagnostic accuracy. Research has demonstrated that expert gaze patterns can greatly improve novices' search significantly and decision-making in medical imaging (Lee et al., 2022; Gegenfurtner et al., 2017; Borg et al., 2018). Similarly, research by Arthur & Sun (2022) and Quen et al. (2021) supports the idea that structured eye-tracking training lowers interpretation errors and enhances diagnostic skills. Compared to earlier research, the present study offers additional information about the efficacy of structured training regimens that concentrate on lung comparisons and costophrenic angle assessments. This study provides a more thorough examination of how training influences particular diagnostic criteria, such as the time to first fixation and duration of fixation on pathology

Research by Van der Gijp et al. (2017) and Borg et al. (2017) highlighted how expert gaze behaviours can help novice radiographers become more attentive and make better decisions. By offering practical evidence of the impacts of focused training interventions, particularly in the context of chest X-ray analysis, the current study expands on these previous findings.

The following are some significant implications of the findings, which support the inclusion of expert gaze training in radiography education:

- Including gaze-based feedback mechanisms to improve student learning.
- Creating focused training plans with a focus on lung comparisons and costophrenic angle checks.
- Making use of gaze-tracking data to evaluate students' development and modify teaching strategies.

5.3 Summary of Findings

Section 4.2.2 demonstrates a significant difference in novices' pre- and post-training gaze behaviours for certain pathologies, with rejection ranging from 35% to 76% per image (Table 4.5).

This study provides insights for lecturers, allowing them to see students' image analysis habits and trends. According to the findings, structured instruction based on expert gaze behaviours can improve novices' performance in analysing chest X-ray images, which aligns with prior studies that used eye-tracking for training. These findings demonstrate that eye-tracking technology can be a useful tool in training radiography students. The utilisation of eye-tracking when training radiographers can improve novice radiographers' diagnostic skills.

5.3.1 Reassessing the Research Objectives

The aim of the study was achieved through the research objectives (RO) listed in Section 1.3.3 and the following conclusions were made:

To address RO₁, gaze behaviour data was collected from first-year Radiography students and fourth-year Radiography students. Sections 3.3.4 and 3.3.5 discussed the process of data collection. The images that were analysed (Appendix A) and the criteria that need to be followed were discussed in Section 3.3.4.

The RO₂ was achieved by comparing the pre- and post-training gaze behaviour data of the novices to determine whether the gaze behaviour of the fourth years has an impact on the first-years gaze behaviours. The data analysis process is outlined in Section 4.2.

To address RO₃, the study revealed the novices' strategies and trends when analysing the chest X-ray images. The novices focus on areas that are not of diagnostic value and their eye movements are chaotic (Section 2.5, & Section 4.2). Appendix E show examples of combined set of heat maps from novices' pre- and post-training as well as experts heat maps. Novices' pre-training heat maps indicate the initial area of focus when analysing the chest X-ray images. Novices initially demonstrated scattered fixation patterns, dividing their focus between different areas of the X-ray image. This could indicate that they are not sure where to concentrate and they are not able to recognise important diagnostic areas, resulting in inaccurate interpretations or missed diagnoses. Appendix E pre-training heat maps indicate that novices might not be familiar with diagnostic areas of the chest X-ray image. These indicate that novices find it difficult to understand complex areas of the chest X-ray image. Additionally, the aggregated heat maps may indicate that the novices fail to identify patterns that point to certain pathologies (such as pneumothorax or lung cancer). Their lack of experience may be reflected in their heat maps, which indicate a lack of focused attention to such patterns.

Experts heat maps were used to train the novices. After training, novices' heat maps showed enhanced skills when it comes to focusing on relevant diagnostic areas. Additionally, novices

demonstrated shorter fixation duration, indicating that they instantly recognised the pathology. The training made it easier for novices to identify patterns. Novices' post-training eye movements indicated that the novices may start to mimic experts, who use a more methodical approach to image analysis. After training, novices paid less attention on areas of the chest X-ray image that are not of diagnostic importance. This indicates that novices have learned to filter out irrelevant areas and concentrate on important diagnostic areas. The post-training data indicate successful learning process, demonstrating that the novices have acquired the necessary knowledge to effectively analyse the chest X-ray images.

To discuss RO₄, lecturers can utilise eye-tracking to structure their lessons and to train radiography students. Heat maps and gaze plots can reveal the areas that students focused on during the chest X-ray analysis. Therefore, lecturers can use this feedback to show students where they focused during the analysis and explain to them if these areas were relevant or irrelevant. Additionally, the feedback can be used to identify significant areas the students might have missed. This allows lecturers to target specific weaknesses during their lessons and help plan their next lessons. Furthermore, lecturers can adjust their teaching strategies to meet the needs of each individual student based on the eye-tracking results. Lecturers can teach students how expert radiographers analyse X-rays by displaying the heat maps and the gaze plots from experts. Experts' patterns and techniques, on how to analyse the chest X-ray image, where to fixate first and how to identify pathologies quickly, can be taught to students. Section 5.3.2 highlight more teaching guidelines for radiography students using eye-tracking.

5.3.2 Reflection on the Hypotheses

The hypotheses for the study were listed in Section 1.4. The following conclusions were made:

$H_{0,1}$: Table 4.4 on CBL shows that a significant difference was observed in 35% of the images when novices compared both lungs. Since no significant difference could be found for most of the images, $H_{0,1}$ cannot be rejected. This shows that gaze behaviours cannot distinguish between chaotic eye movements across the image and participants checking both lungs. Studies suggest that novices tend to have disorganised eye movements (Borys & Plechawska-Wójcik, 2017). As a result, it is likely that participants appeared to be comparing both lungs before training whereas they were uncertain where to concentrate their attention. Figure 2.13 demonstrates a novice observer's disorganized eye movements. Alternatively, the participants could have simply examined both lungs as per the criteria of analysing the chest X-ray.

$H_{0,2}$: Table 4.4 on CCA demonstrates that there is a significant difference between novices' pre- and post-training when checking the costophrenic angle. $H_{0,2}$ may be rejected for 76% of the images when novice pre-post training results are compared. Indicating that most participants looked at the costophrenic angles, which is an important diagnostic procedure for pleural effusions and other disorders. The training was beneficial because 13 out of the 17 cases showed significant post-training differences, suggesting that participants became more thorough when analysing the chest X-ray images.

$H_{0,3}$: Table 4.4 on CA suggests that participants accurately identified the pathology in most of the cases, demonstrating good overall diagnostic ability. The correct identification of pathologies after training significantly improved in 12 out of the 17 cases. Additionally, the novices' gaze behaviour data indicated that there is an improvement after the training. Moreover, correctly identifying the

pathology does not necessarily mean that the observer fixated on or was aware of the pathology, it could be a result of conjecture or chance. Furthermore, gaze behaviours cannot distinguish between participants who knew how to identify the pathology and the participants who identified the pathology correctly by chance. Therefore, correctly identifying pathology criterion, combined with other criteria such as checking the costophrenic angles, fixating on the pathology, and checking both lungs, contributes to more accurate results.

$H_{0,4}$: Table 4.4 demonstrates that there is a significant difference between novices' pre- and post-training T2FF chi-square and t-test results. This suggests that after the training, participants were instantly drawn to the pathology. Table 4.4 indicates that the training was beneficial in this area because 11 out of the 17 images had a significant difference in the Time to First Fixation after the training. The Time to First Fixation on the pathology does not always indicate whether the participant completely understands what they are doing. This metric is used to determine how quickly a participant's gaze is drawn to the pathology. Ludwig et al. (2022) states that cognitive errors occur when an imaging specialist fails to notice a pathology despite focusing on it. As a result, a participant might quickly gaze at the pathology and fail to accurately identify it (Section 2.2.5). However, a shorter Time to First Fixation may indicate faster recognition of the pathology, implying a higher level of expertise.

$H_{0,5}$: Table 4.4 DoF criteria demonstrates that after the training more participants focused on the pathology for a significant amount of time and were better at recognising the pathology. Therefore, $H_{0,5}$ may be rejected for 59% of the images after training. The findings indicate that the fixation duration on pathology was significantly different in 10 out of the 17 images after training, suggesting that the training may have enhanced the participants ability to focus on diagnostically relevant areas of the chest X-ray image. However, a longer fixation duration on the pathology may

indicate a more thorough analysis or attentive assessment of pathology. It could also imply an increased engagement or cognitive processing. On the contrary, a shorter Duration of Fixation may indicate faster recognition, which may be related to higher expertise.

A significant post-training performance was shown in the participants' ability to correctly analyse a chest X-ray image suggesting that the training significantly improved participants' ability to focus on significant areas of the image. In conclusion, Table 4.4's data demonstrates that training has significantly improved novices' diagnostic abilities regarding Time to First Fixation on the pathology, Duration of Fixation on pathology, checking costophrenic angles and correctly identifying pathologies. When analysing the chest X-ray images, the influence of experts' gaze behaviours on novices is confirmed.

5.3.3 Teaching guidelines for radiography students using eye-tracking

This study provides insights for lecturers, allowing them to detect students' image analysis habits and trends. According to the findings, structured instruction based on expert gaze behaviours can improve novices' performance in analysing chest X-ray images, which aligns with prior studies that used eye-tracking for training. For example, Arthur and Sun (2022) assessed the use of eye-tracking and concluded that it could improve educational methods and interpretation techniques for novices. Additionally, Gegenfurtner et al. (2017) conducted an evaluation and discovered that eye-tracking technology is beneficial in medical education for monitoring and improving performance. These studies demonstrate that incorporating eye-tracking technology into teaching can effectively enhance the diagnostic skills of novices, aligning with the findings of the current study.

The students were shown how to visit the correct elements during the chest X-ray analysis. The aggregation of the experts' heat maps and the gaze plots were used to show the student which elements to visit. Real-time feedback based on students' eye movements were provided. These data allow lecturers to highlight areas that got more attention from the students. Based on this data lecturers can highlight the areas that may need improvement. The gaps in students' analysis techniques may be identified by the lecturers.

Lecturers can instruct students to focus on significant anatomical areas during the chest X-ray analysis, as they can see where the students focused. The use of eye-tracking guides students' attention to the crucial areas. With the real-time feedback from eye-tracking, the lecturers can instantly modify the eye movements of the students and enhance their ability to recognise pathologies. Furthermore, students' progress can be evaluated over time using eye-tracking data, which reveals improvements in their analysis skills and pathology identification. Lecturers can use this information to plan their next lessons and how they can guide students to focus on significant, relevant areas.

5.3.4 Correct answer vs fixating on the AOI

The study demonstrated that correctly identifying the pathology does not necessarily mean the participants focused on relevant areas. Bruno, Walker and Abujudeh (2015) argue that participants must focus on the pathology to correctly identify the pathology. During data collection, the researcher observed that some participants who did not fixate on the AOI manage to identify pathology correctly. This could mean that participants only guessed the correct pathology based on the options that were provided. Figure 5.1 below shows one case of a Lung Cancer chest X-ray image where participant 10 did not fixate on the AOI but still managed to correctly identify

pathology correctly. This is not the only case of this nature; more cases can be observed in Appendix L.

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	No	Yes	Yes
Participant 4	Yes	Yes	No	No
Participant 5	Yes	No	No	Yes
Participant 6	Yes	Yes	No	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	No	No	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	Yes	Yes	Yes	No

Figure 5. 1: An Example of a case of Lung Cancer chest X-ray image where participant did not fixate on the AOI but still managed to correctly identify the pathology.

5.4 Discussion of problems

While the hypotheses have been confirmed, it is crucial to consider different characteristics amongst novices and their cognitive abilities. Future research could investigate individualised training approaches to enhance the beneficial effects of expert gaze behaviour. Therefore, it is suggested that eye-tracking technology can be used across all levels of radiography training, from first-year level to fourth-year.

5.5 Concluding remarks

This study aimed to use eye-tracking technology to guide radiography students on the correct elements to visit when analysing the chest X-ray images, and how to correctly identify pathologies.

The study aimed to address the research question: *To what extent does the gaze behaviour of radiography experts influence the gaze behaviour of radiography students when analysing X-ray images?* Developing research objectives was critical to answering the research question.

The findings demonstrate that eye-tracking technology can be a useful tool in training radiography students. The utilisation of eye-tracking when training radiographers can improve novice radiographers' diagnostic skills.

5.6 Recommendations for implementation

Using a single eye-tracking metric may not capture the full details of cognitive processes or visual attention but may still provide useful data. Section 5.3.3 highlight participants who did not fixate on the correct AOI but still managed to correctly identify the pathology. This demonstrated that correctly identifying the pathology does not necessarily mean the participants focused on relevant areas. Therefore, to accurately interpret the participant's comprehension and cognitive processes, it is important to use different metrics. Sections 3.3.6 and 3.3.11 highlight the criteria used to analyse the data collected. The findings support the use of eye-tracking technology in Radiography to train the students and to improve teaching.

Eye-tracking may also be used as a form of evaluating tool for examinations. Eye-tracking data can be used to evaluate individual performance and deliver individualised comments. Highlight the strengths and areas for improvement to personalise the instruction to each novice's specific need. The lecturer will therefore be able to see where the students focused on, and this will also give an insight into whether the pathology was guessed or whether the student truly focused on relevant areas.

The use of eye-tracking technology in radiography education can be enhanced, resulting in increased diagnostic accuracy and confidence among novices. This strategy ensures effective, individualised and constantly evolving training to fit the needs of students and the demands of the Radiography field.

5.7 Summary of Contributions

Incorporating eye-tracking with radiography leads to diagnostic improvements. This technique assists in distinguishing between novice and expert radiographers' gaze behaviours, providing significant insights regarding image analysis habits and trends. This comprehension can lead to greater diagnostic efficiency and accuracy.

Eye-tracking is a useful tool to assess students during examinations. The use of eye-tracking can assist lecturers in determining if students focused on the relevant areas after correctly identifying the pathology. Eye-tracking can reveal the areas observed by the students and whether they followed the criteria when analysing the X-ray images. Consequently, the students will also learn to follow the correct criteria and gain confidence when analysing the X-ray images. Radiography lecturers can improve teaching methods by utilising eye-tracking data. According to the findings, structured education based on expert gaze behaviours has the potential to improve the performance of novices when analysing chest X-ray images.

5.8 Limitations of the Study

This research, like any other, had limitations. Due to the deployment of distant learning, three fourth-year students withdrew from the study. This decision was motivated by the fact that data gathering took place during the COVID-19 restrictions, which prevented some students from going to campus. Consequently, the generalisability of the findings was affected. The findings of the

study cannot be generalised due to the small sample size and the use of a non-representative sample.

Another limitation of the study was the use of fourth-year students as a reference group for experts. Since these students are still in training, using experienced radiographers as the expert benchmark could have resulted in significantly different results.

Furthermore, parametric t-tests were done without verifying normality of data. Although very unlikely, non-parametric tests might have led to different results. Tests for normality will be included in follow-up studies.

Lastly, during data collection, the researcher discovered that some participants correctly identified the pathology without fixating on the AOI. This suggests that participants may have correctly identified some pathologies by guessing, as the list of possible pathologies was presented during data collection process.

5.9 Suggestions for future research

The study focuses on how novices' gaze behaviours are influenced by the gaze behaviours of experts. Future research could be conducted to see if it would be more effective if expert radiographers were to develop an optimised, specific search pattern to train novice radiographers. This analysis could reveal whether novices can learn faster by utilising expert-like search patterns, which might lead to improved efficiency and accuracy when analysing chest X-ray images.

5.10 Summary

This study sheds light on how the experts' gaze behaviour impacts the novices' gaze behaviours during chest X-ray image analysis. Valuable insights have been gathered using eye-tracking

technology, laying the groundwork for instructional advances in radiography education. The study has demonstrated that the use of eye-tracking in radiography can improve the novices' gaze behaviour. Lecturers can use eye-tracking technology to structure their lessons and may also use eye-tracking for assessments.

In summary, eye-tracking in radiography contributes to educational advancements, training improvement, diagnostic process improvements and the supply of practical guidance for lecturers. These contributions together contribute to the growth of radiography education, encouraging an increased knowledge of gaze behaviours and improving radiography professionals' overall performance.

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Appendix A – Stimuli

1. Introduction

This appendix consists of documentation of the stimuli used in the research. It includes the chest X-ray images that novices and experts analysed during the experiment. This appendix is referenced in Section 2.2.2, Section 3.3.1 and Section 3.3.4. It is divided into three sections, namely:

- Pilot study stimuli – These are the images that were used during a pilot study. A pilot study was conducted to ensure that the most suitable stimuli are used for the study. Six X-ray images were used for the pilot study (Section 3.3.1).
- Pre-training stimuli – There are images that were analysed by novices and experts before that training took place. Seventeen X-ray images were used (Section 3.3.4).
- Post-training stimuli – These are the images that were analysed by the novices after the training. Seventeen X-ray images were used.

2. Pilot study stimuli



Figure 2.1: Pneumo-haemothorax X-ray image in the left lower lung (Sourced from department picture library)

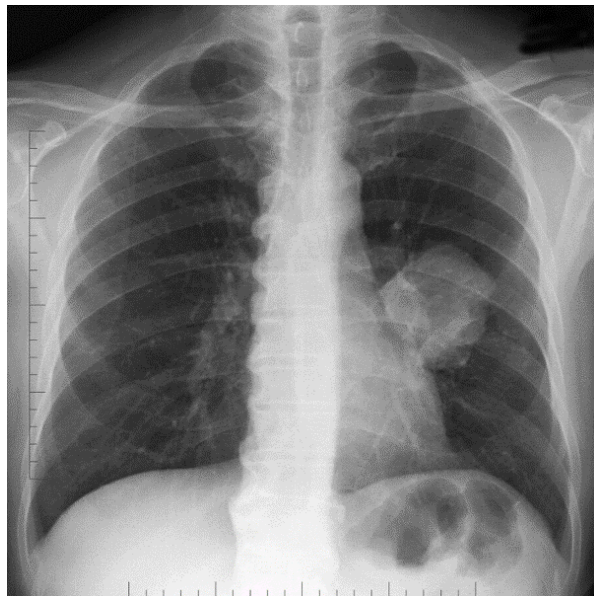


Figure 2.2: Lung Cancer X-ray image in the left lower lobe (File:Chest Xray.Jpg, 2016)



Figure 2.3: Pneumonia X-ray image in both the left and the right lung (Rad_doc, 2013)

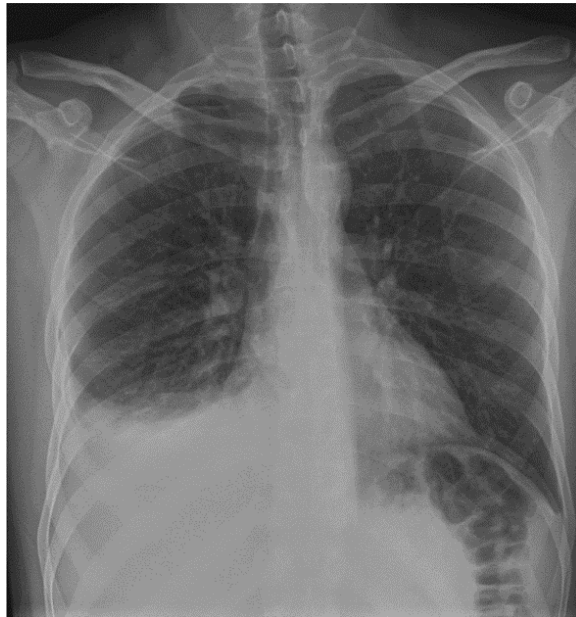


Figure 2.4: Pleural Effusion X-ray image in the right lower lung (Panjwani & Zaid, 2017)



Figure 2.5: Pneumothorax X-ray image in the right upper lung (Sourced from department picture library)



Figure 2.6: Normal X-ray image (slight Right hemi diaphragm tenting) (Rad Crit, n.d.)

3. Pre-training Stimuli



Figure 3.1: Pneumo-haemothorax X-ray image in the left lower lung (Sourced from department picture library)

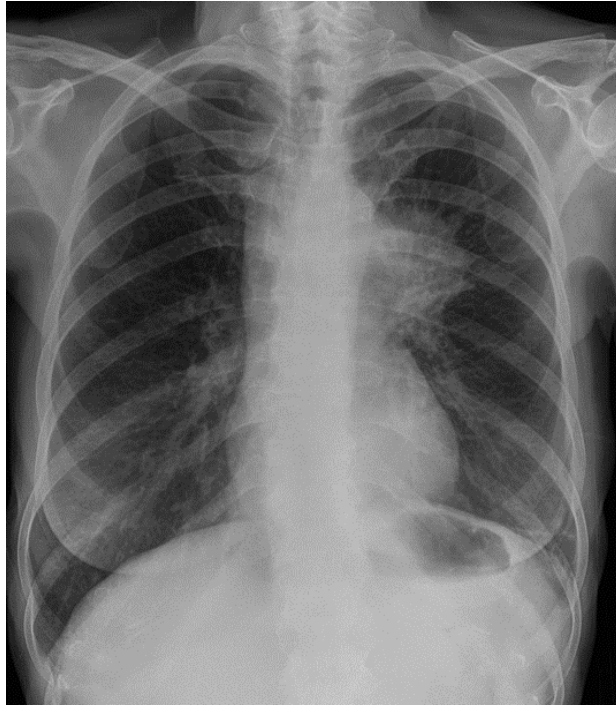


Figure 3.2: Lung Cancer X-ray image in the left upper lung (Bickle, 2017)

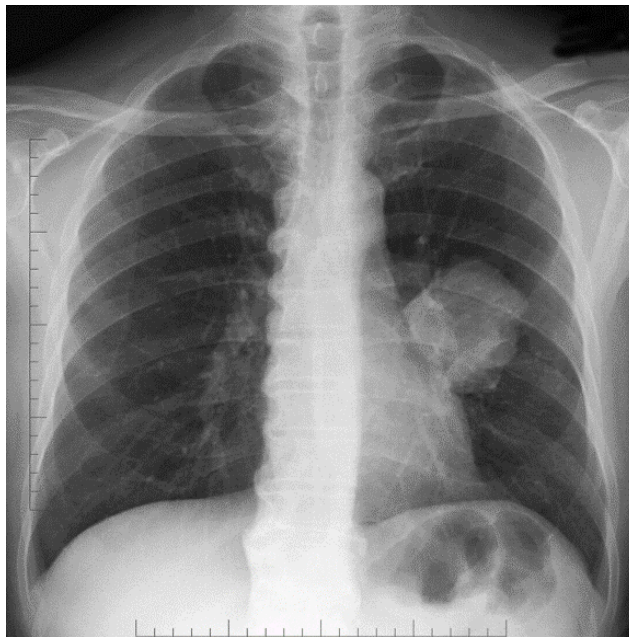


Figure 3.3: Lung Cancer X-ray image in the left lower lung (File:Chest Xray.Jpg, 2016)

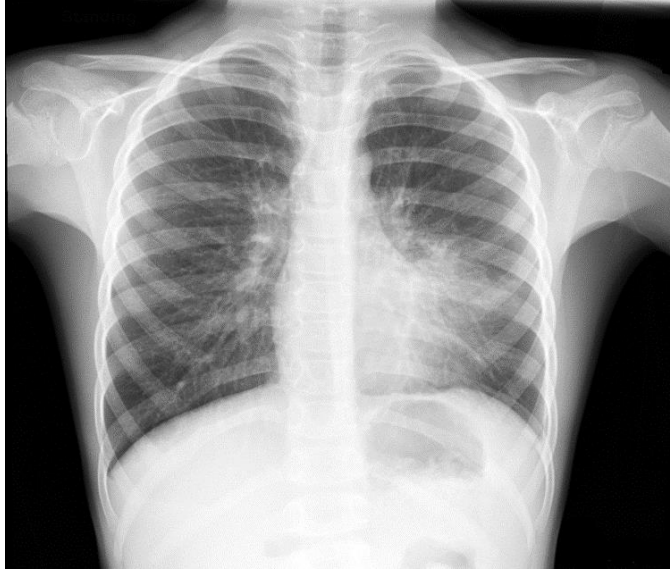


Figure 3.4: Pneumonia X-ray image in both the left and the right lung (Rad_doc, 2013)

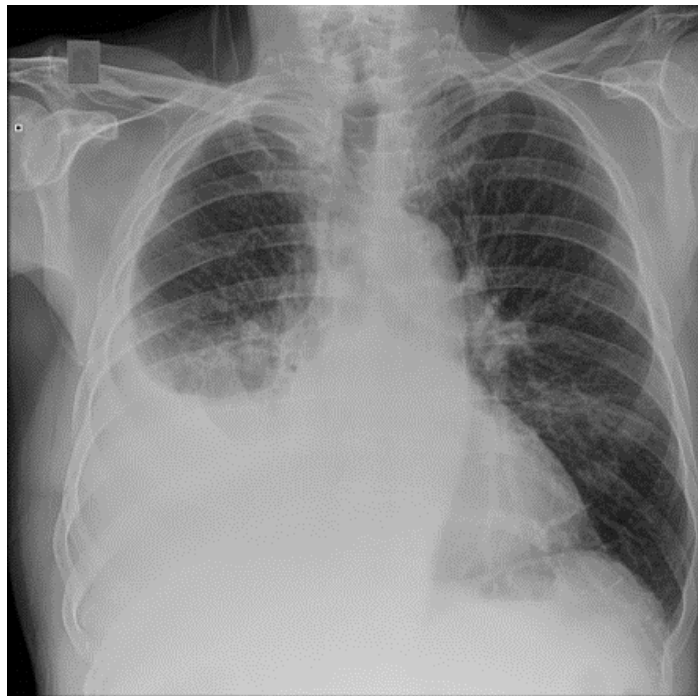


Figure 3.5: Pleural Effusion X-ray image in the right lower lung (Radiopeadia, n.d.)

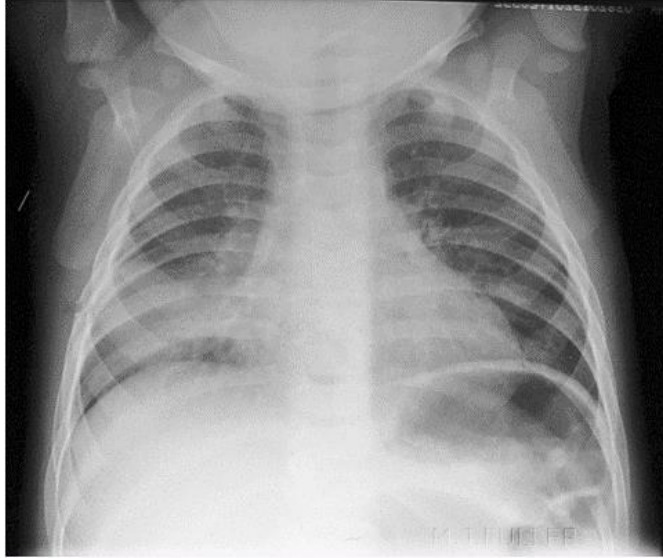


Figure 3.6: Pneumonia X-ray image in the right lower lung (Gaillard, 2010a)

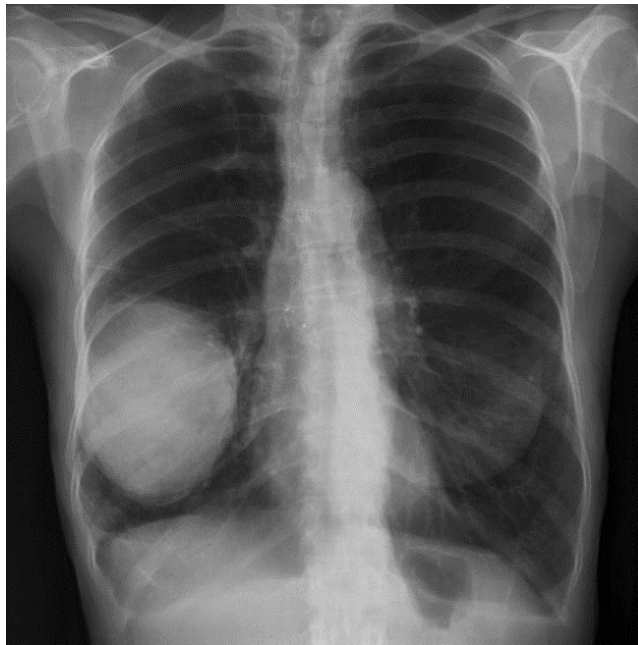


Figure 3.7: Lung Cancer X-ray image in the right lower lung (Gaillard, 2010b)



Figure 3.8: Pneumothorax X-ray image in the left lung (Bickle, 2021)



Figure 3.9: Pneumonia X-ray image in both the right and the left lung (Hacking, Campos & Murphy, 2015)

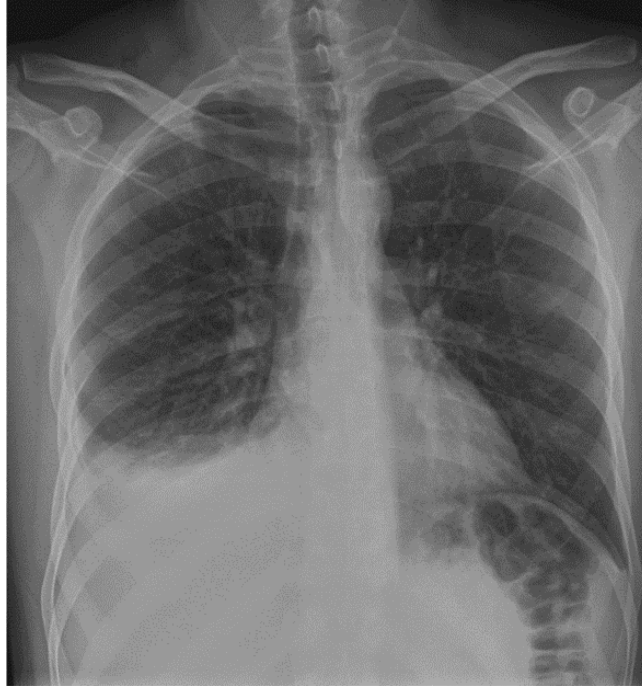


Figure 3.10: Pleural Effusion X-ray image in the right lung (Panjwani & Zaid, 2017)



Figure 3.11: Pneumo-haemothorax X-ray image in the right lung (Sourced from department picture library)



Figure 3.12: Pneumothorax X-ray image in the right upper lung (Sourced from department picture library)



Figure 3.13: Normal X-ray image (Sourced from department picture library)



Figure 3.14: Pleural Effusion X-ray image in the left lower lung (Sourced from department picture library)



Figure 3.15: Pneumothorax X-ray image in the right lung (knipe, 2014)



Figure 3.16 Pneumo-haemothorax X-ray image in the right lower lung (Van, 2016)

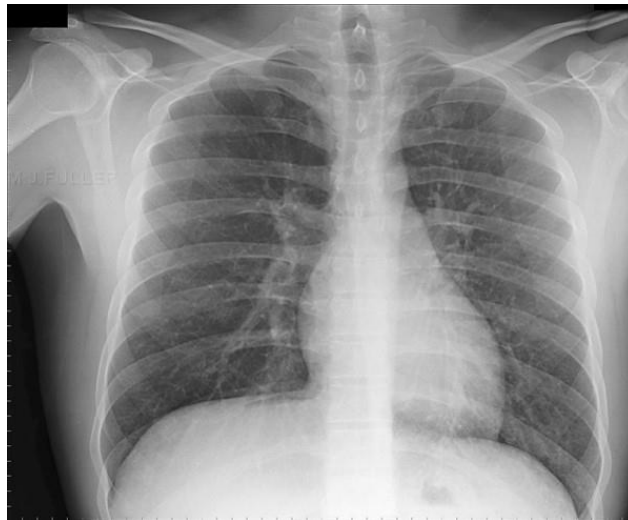


Figure 3.17: Normal X-ray image (Sourced from department picture library)

4. Post-training Stimuli

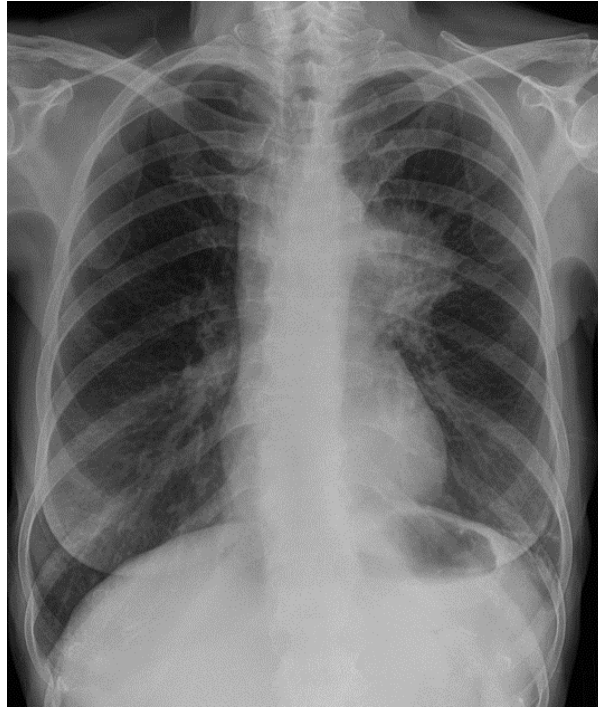


Figure 4.1: Lung cancer X-ray image in the left upper lung (Bickle, 2017)



Figure 4.2: Lung cancer X-ray image in the left upper lung (Willsie, 2010)



Figure 4.3: Lung cancer X-ray image in the left lower lung (Gaillard, 2015)



Figure 4.4: Pneumonia X-ray image in both the left and the right lung (Rad_doc, 2013)

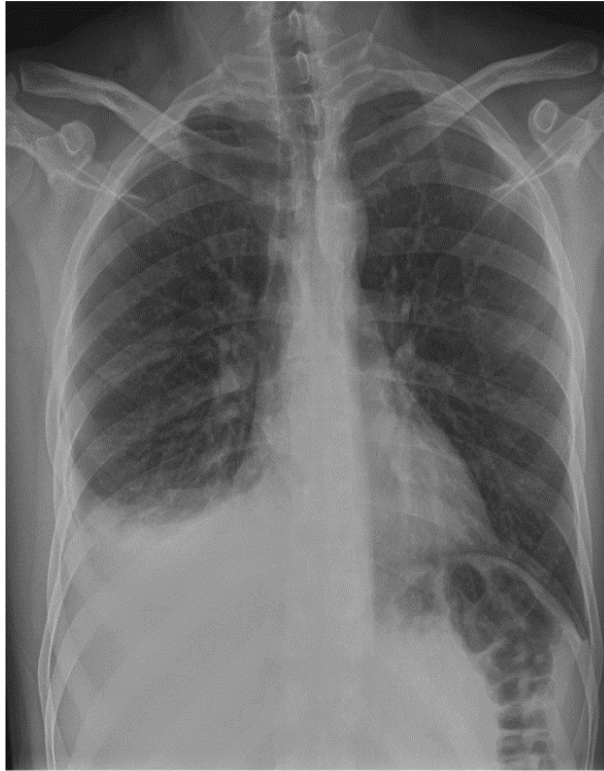


Figure 4.5: Pleural effusion X-ray image in the right lower lung (Panjwani & Zaid, (2017)

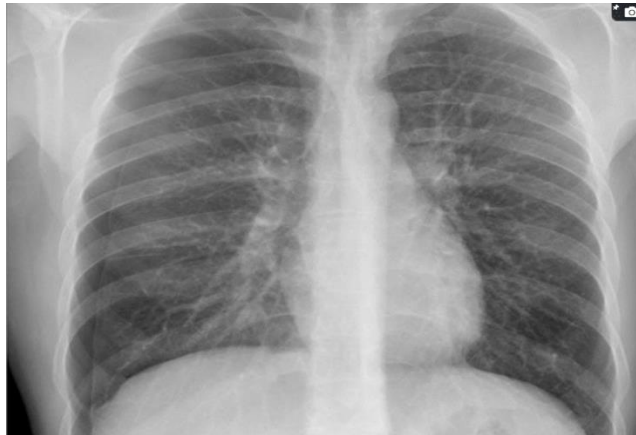


Figure 4.6: Pneumothorax X-ray image in the right lung (Knipe, 2014)



Figure 4.7: Pneumo-haemothorax X-ray image in the left lower lung (Sourced from department picture library)

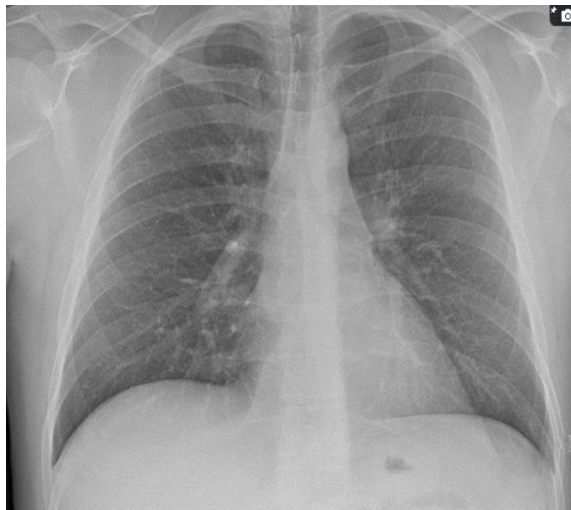


Figure 4.8: Normal X-ray image (Bickle, 2016)



Figure 4.9: Normal X-ray image (X-ray interpreter, n.d.)

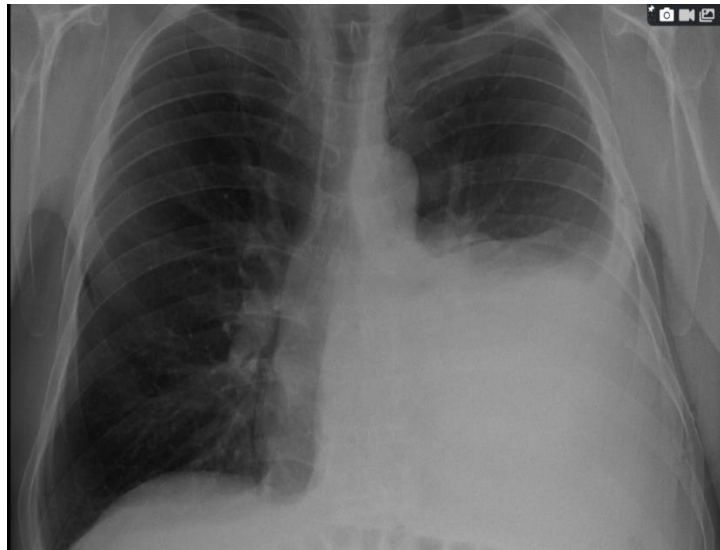


Figure 4.10: Pleural effusion X-ray image in the right lower lung (Moor, 2023)



Figure 4.11: Pleural effusion X-ray image in the left lower lung (Gaillard, 2013)

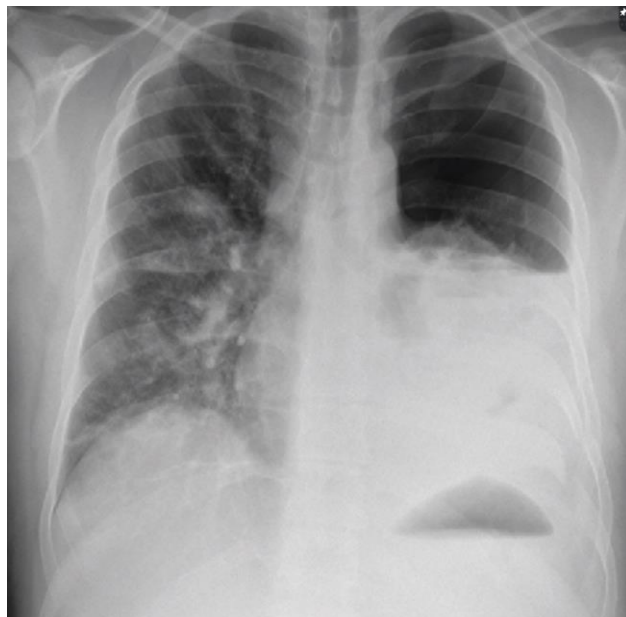


Figure 4.12: Pneumo-haemothorax X-ray image in the right lower lung (de Wolf, Deunk, Cornet & Elbers, 2014)



Figure 4.13: Pneumo-haemothorax X-ray image in the right lung (Knipe, 2017)

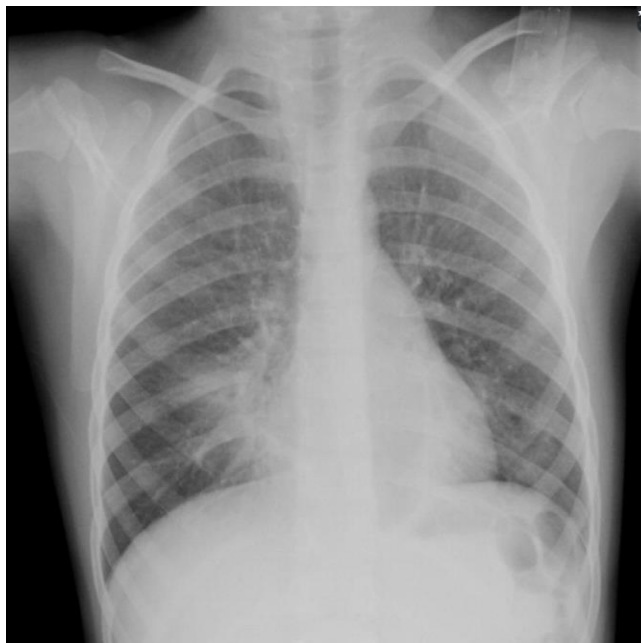


Figure 4.14: Pneumonia X-ray image in both the left and the right lung (Sourced from department picture library)



Figure 4.15: Pneumonia X-ray image in the right lung(<https://gr.pinterest.com/pin/368380444514610794/>)



Figure 4.16: Pneumothorax X-ray image in the left lung (Smith, 2015)



Figure 4.17: Pneumothorax X-ray image in the right lung (Sourced from department picture library)

Appendix B: Answering sheet

1. Introduction

The participants were given questions based on the type of pathology present on each chest X-ray image. The researcher recorded the answers on a paper-based answering sheet for each participant as they examined the chest X-ray images. This appendix contains the answer sheet that participants used. This appendix is referenced in Section 3.3.10.

2. Answering sheet

Table 1.1: Answering sheet

Eye-tracking Test		
Student Name:		Student Number:
X-ray Image No.	Did you see any abnormality?	If yes, what kind of abnormality did you see?
1	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
2	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea

3	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
4	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
5	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
6	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax

		☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
7	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
8	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
9	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea

10	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
11	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
12	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
13	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax

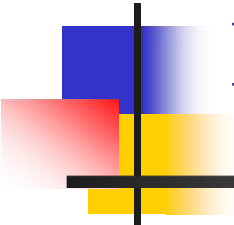
		☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
14	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
15	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
16	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea

17	☐ Yes ☐ No	☐ Pneumonia ☐ Pleural effusion ☐ Pneumothorax ☐ Pneumo-haemothorax ☐ Lung Cancer ☐ Normal X-ray ☐ I have no idea
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Appendix C – Preparation material

1. Introduction

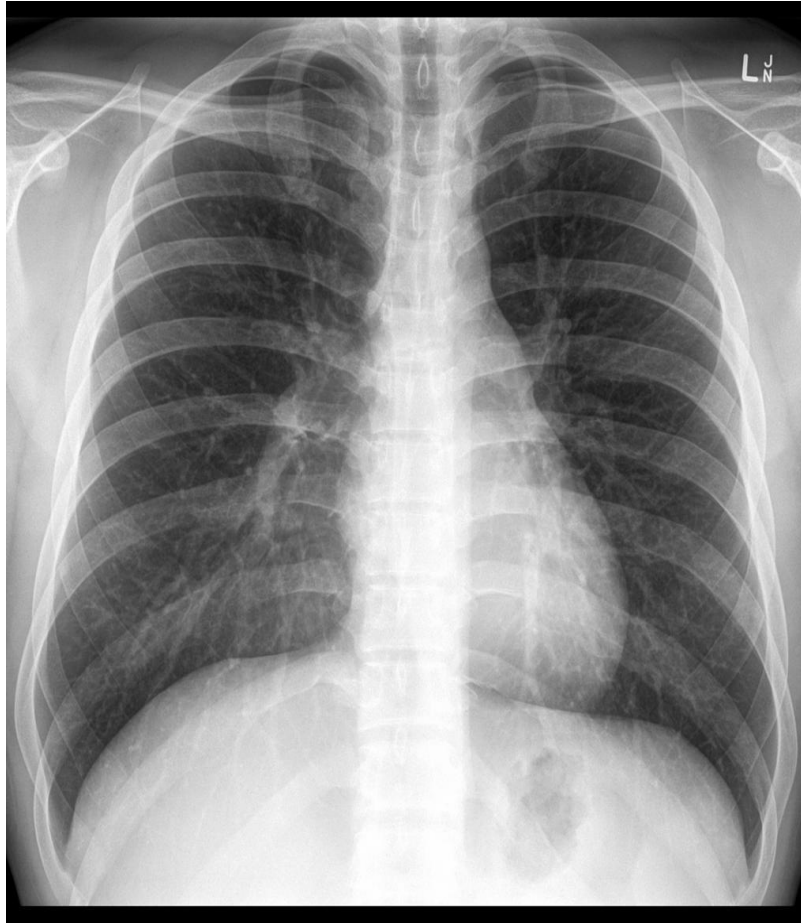
This appendix presents the material based on chest X-ray pathologies that was provided to first-year students to prepare for the eye-tracking test. This preparation material was theory-based, and the students were given a week to go through the lesson before being tested. This preparation material is referenced in Section 3.3.3. The preparation material provided was uploaded on eThuto – which is an online Blackboard portal of CUT via which students obtain crucial program information by logging into the university website, so that all the students who are part of the study may have access to the lesson.



INDICATIONS FOR CXR

Pathology introduction

2. Normal lung



3. Indication (Why?)

- Patient to theatre
- Condition of lungs (PA & Lat)
- Patient in ICU
- AP semi-erect (monitoring)
- Situs Inversus

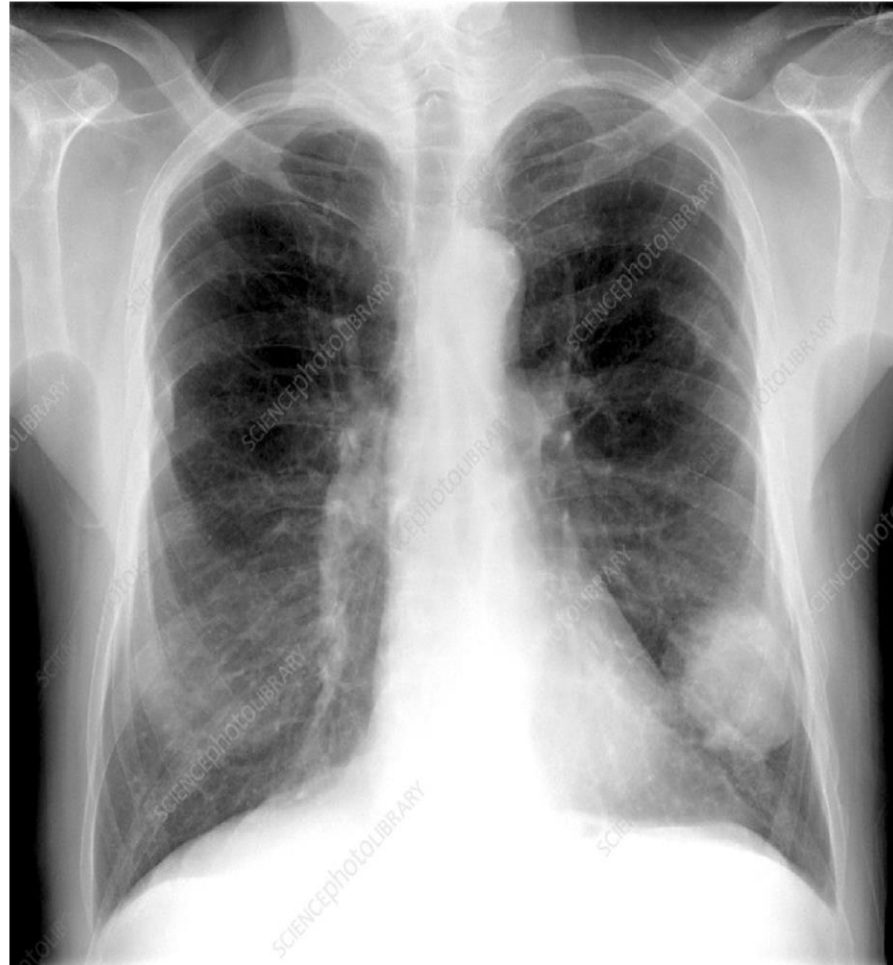
- Expect organs on other side.

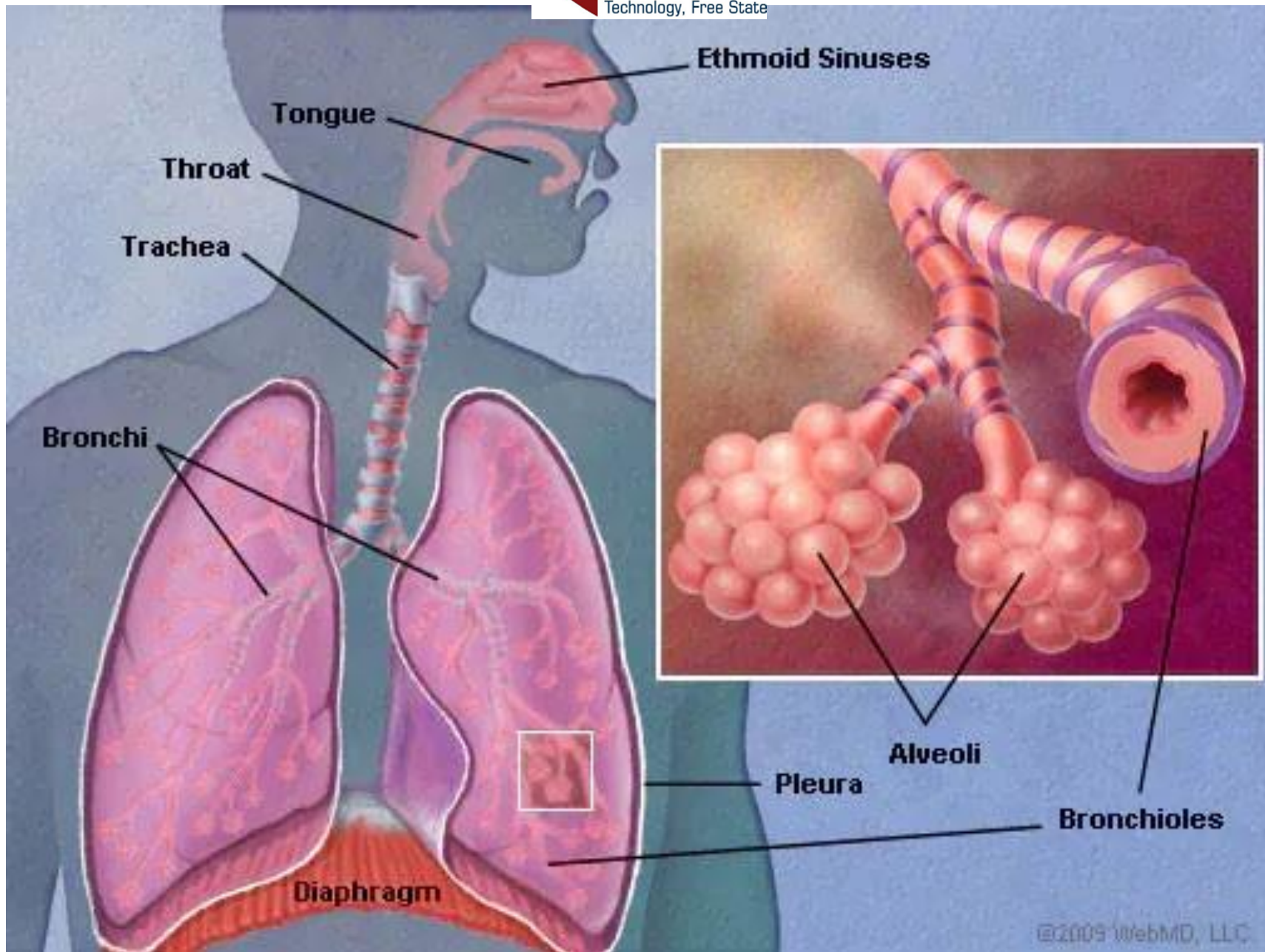
- Aspiration

AP & Lat (foreign objects in bronchi)

- Pathology (cancer, TB, pneumonia, etc.)

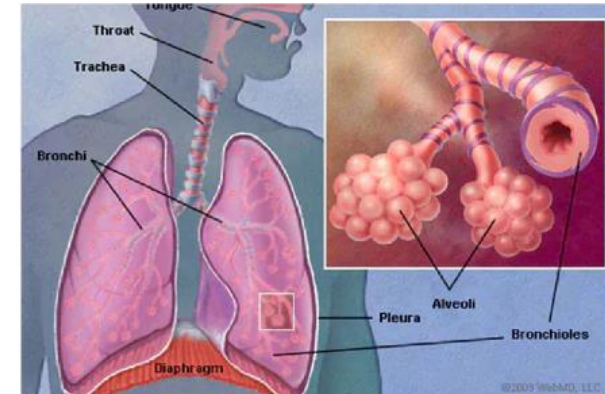
4. Lung cancer





Bronchiectasis

- widening of bronchi, filled with mucus, from repeated infections.
- Bronchitis – acute or chronic
- Mucus in bronchi, shortness of breath
- Pneumonia
- Result in oedema
- Exposure factors ↑ because of fluid



**Cystic Fibrosis -
Bronchiectasis**

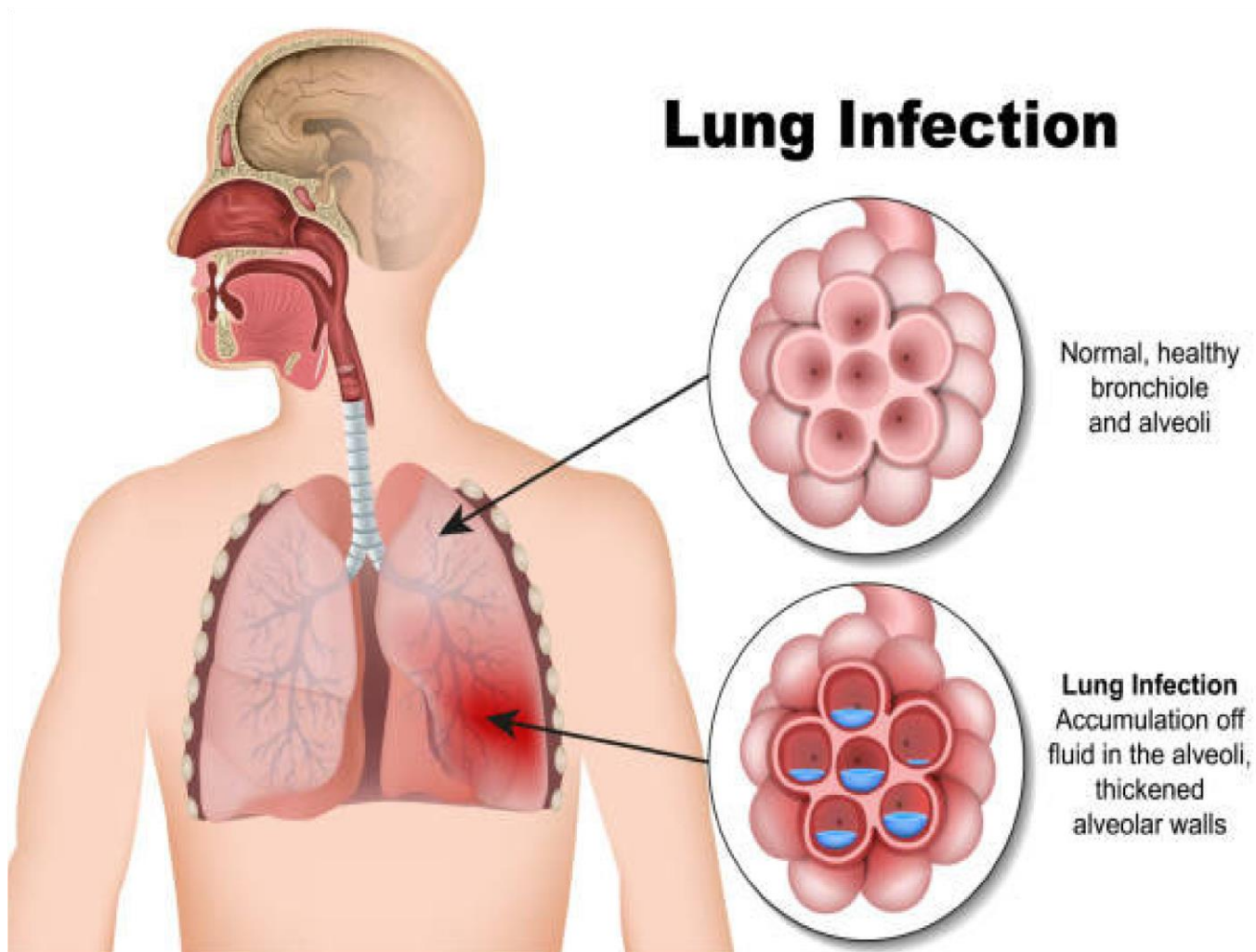
Bilateral diffuse
Multiple cavities /
Bronchiectasis
Peribronchial
fibrosis
Prominent hilum
Hyper inflated



5. Pneumonia

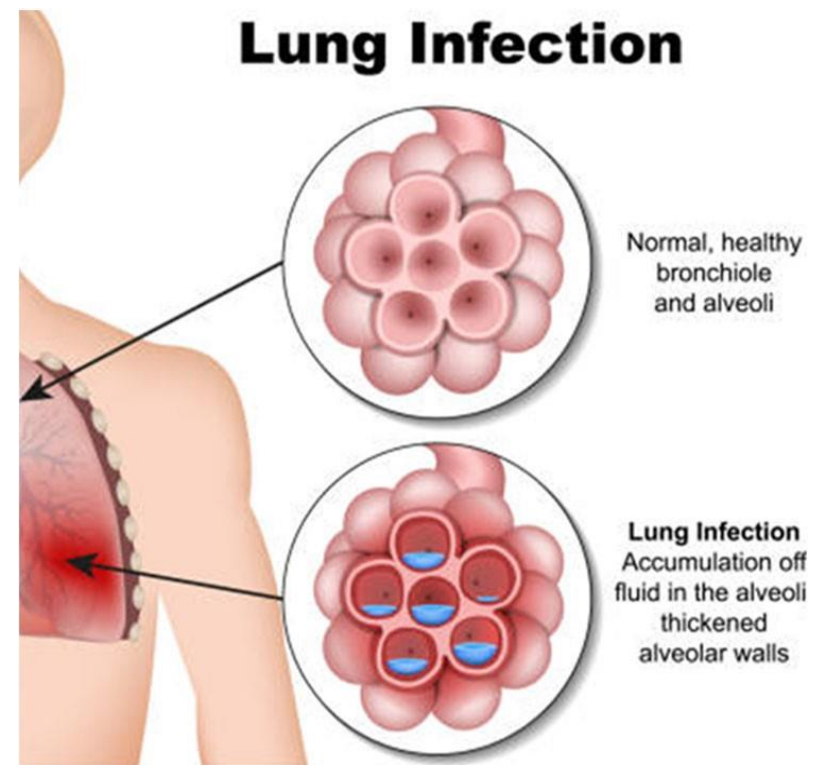


6. Pneumonia/inflammation



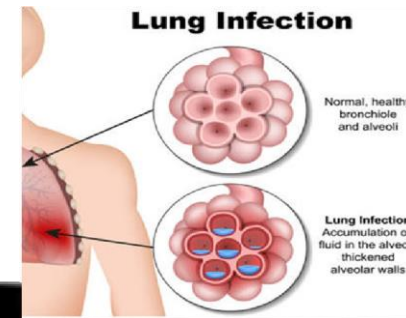
Alveolar Pneumonia

- Inflammation of the lungs where **alveoli are filled** with inflammatory exudate (fluid)
- Patient has problems with breathing
- Routine projections
- Air-bronchogram sign
 - Air in bronchi, but alveoli filled with fluid.

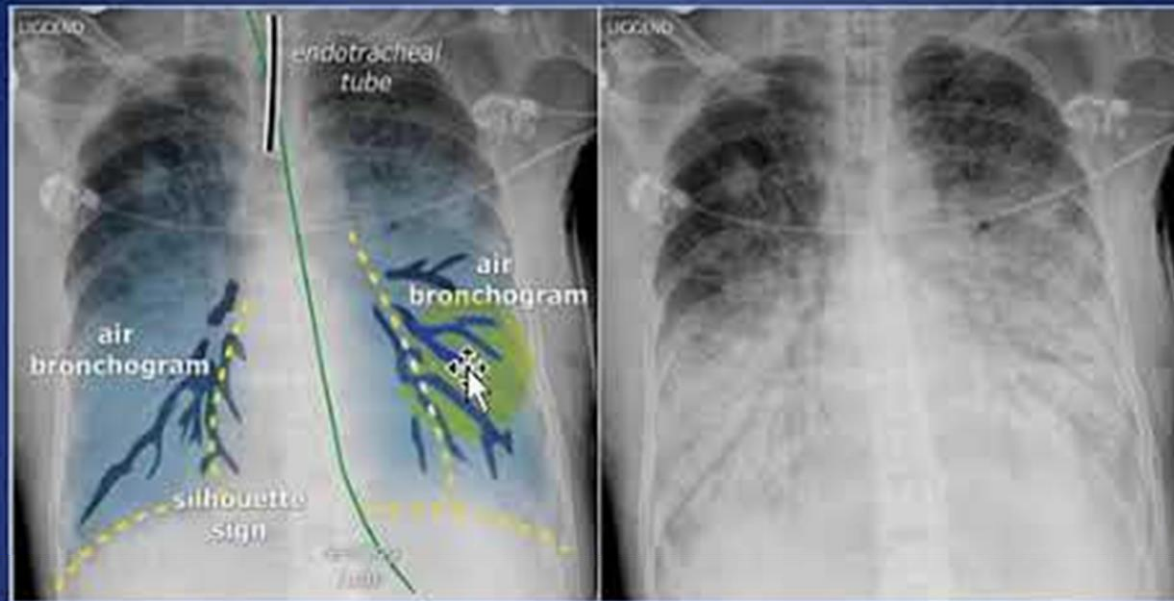


Air bronchogram

The air column in the bronchi beyond the 4th order becomes recognizable if the surrounding alveoli are filled, providing a Contrast, or if the bronchi get thickened



7. Air bronchogram



<http://www.startradiology.com/internships/internal-medicine/thorax/x-thorax/>

Pulmonary Edema (fluid in alveoli)

Acute onset – heart failure

Bilateral diffuse alveolar
disease

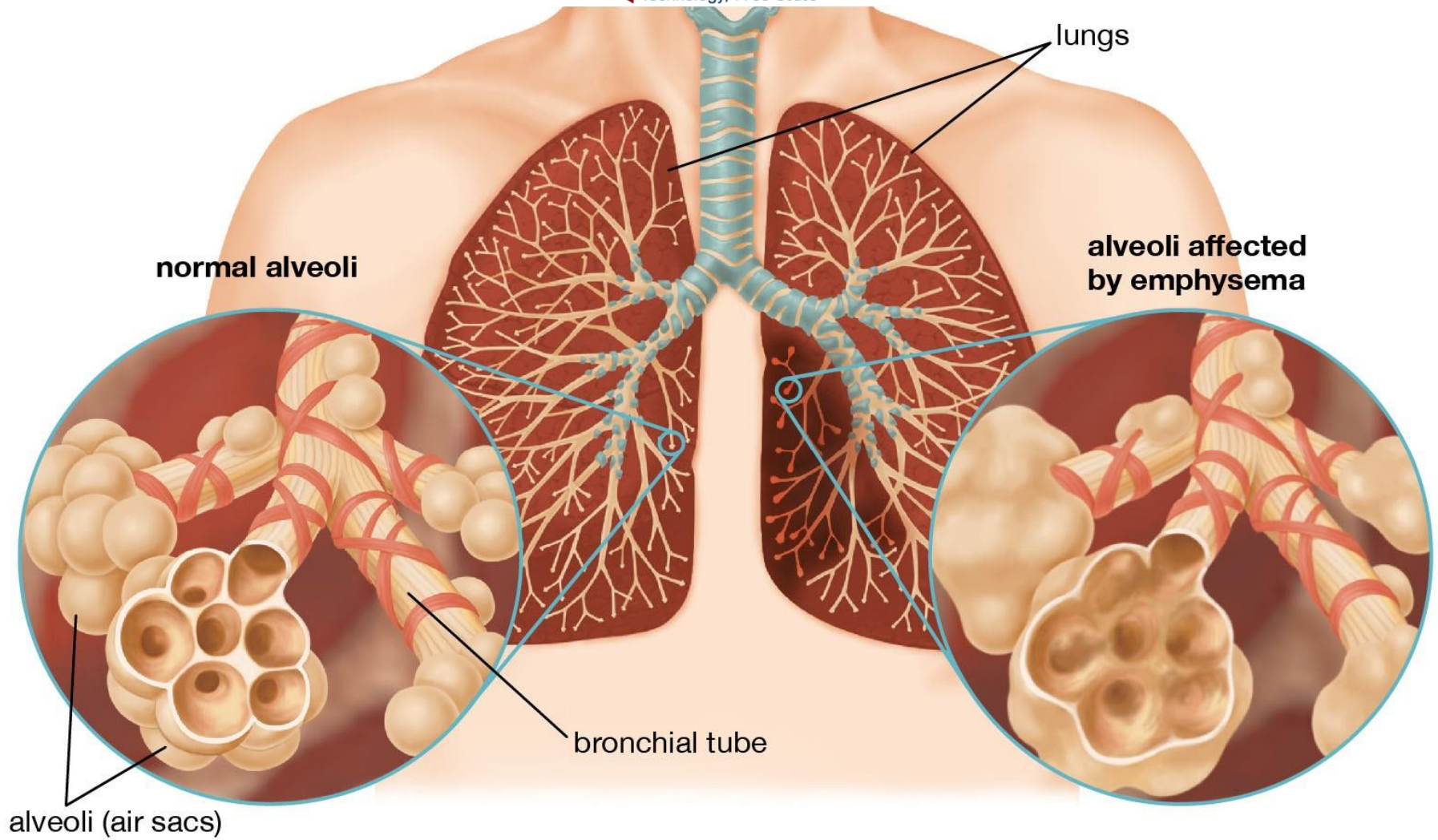
Bilateral pleural effusions
Costophrenic angles at the
bottom clearance with
treatment



8. Lung Emphysema

- Terminal **bronchioles become dilated.**

& lose effectiveness (hyperinflation)
- Breathing difficult
- Increased dimensions of lungs
- Routine projections
- Exposure factors lowered to prevent overexposed radiographs.



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9. Emphysema (repeat)

- Chronic lung disease
- Alveoli air spaces become enlarged.
- Loss of alveolar elasticity
- Air cannot be expelled during expiration.
- Increased lung dimensions (barrel-chest)
- Obscure costophrenic angles
- Elongated - shadow.
- Radiolucent lungs (↓ exposure factors)

Emphysema



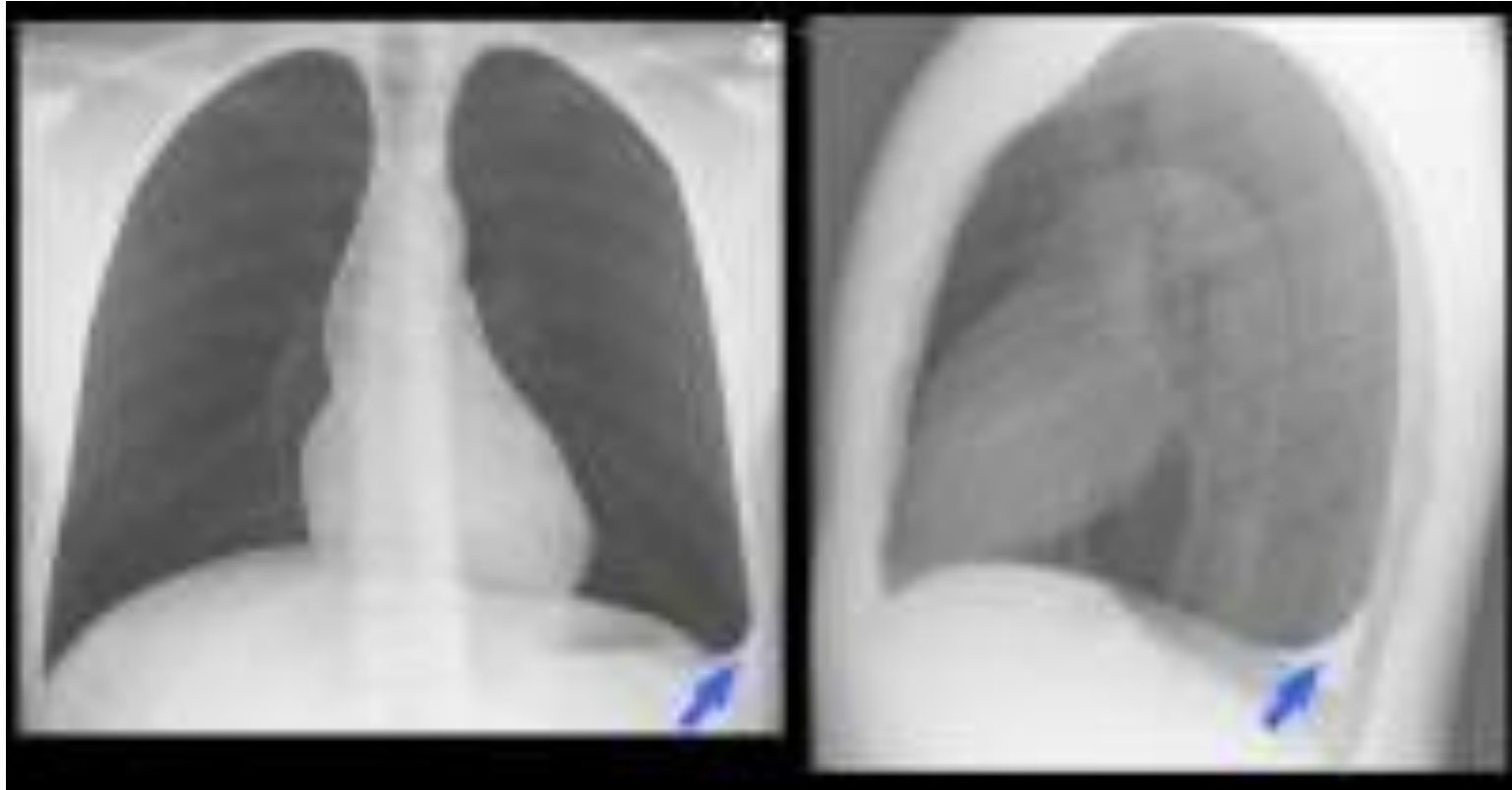


A lateral chest x-ray of a person with emphysema. Note the **barrel chest and flat diaphragm.**

10. PLEURAL EFFUSION

- Abnormal accumulation of fluid in the **pleural cavity**
- Haemothorax – accumulation of blood in pleural cavity
- PA & Lat erect (to see level of fluid) or lateral decubitus
(patient must lie on side of haemothorax if possible)

11. Pleural effusion



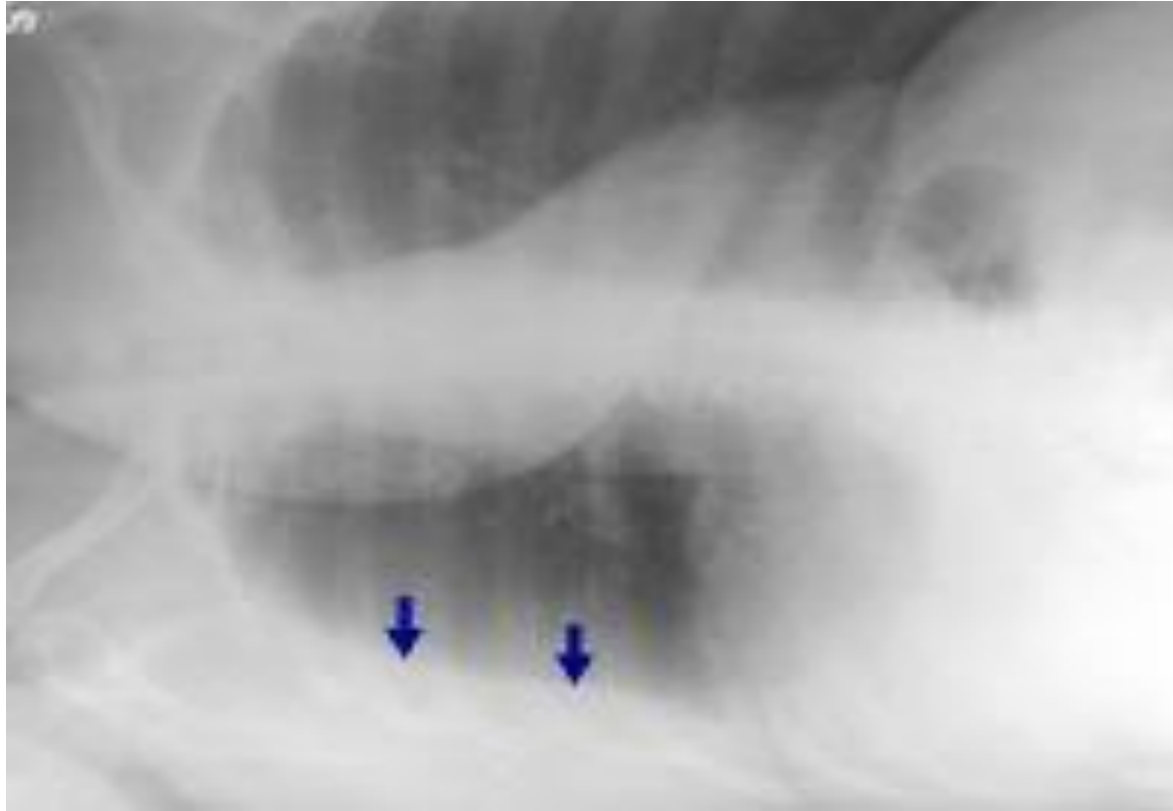
12. Pleural Effusion

- Fluid in the pleural cavity
- PA Thorax (erect)

Or

- Lat decubitus (lie on pathology side)
- Penetrated PA Thorax
- AP supine (to determine if fluid is localized/spread with position change)

13. Decubitus pleural effusion



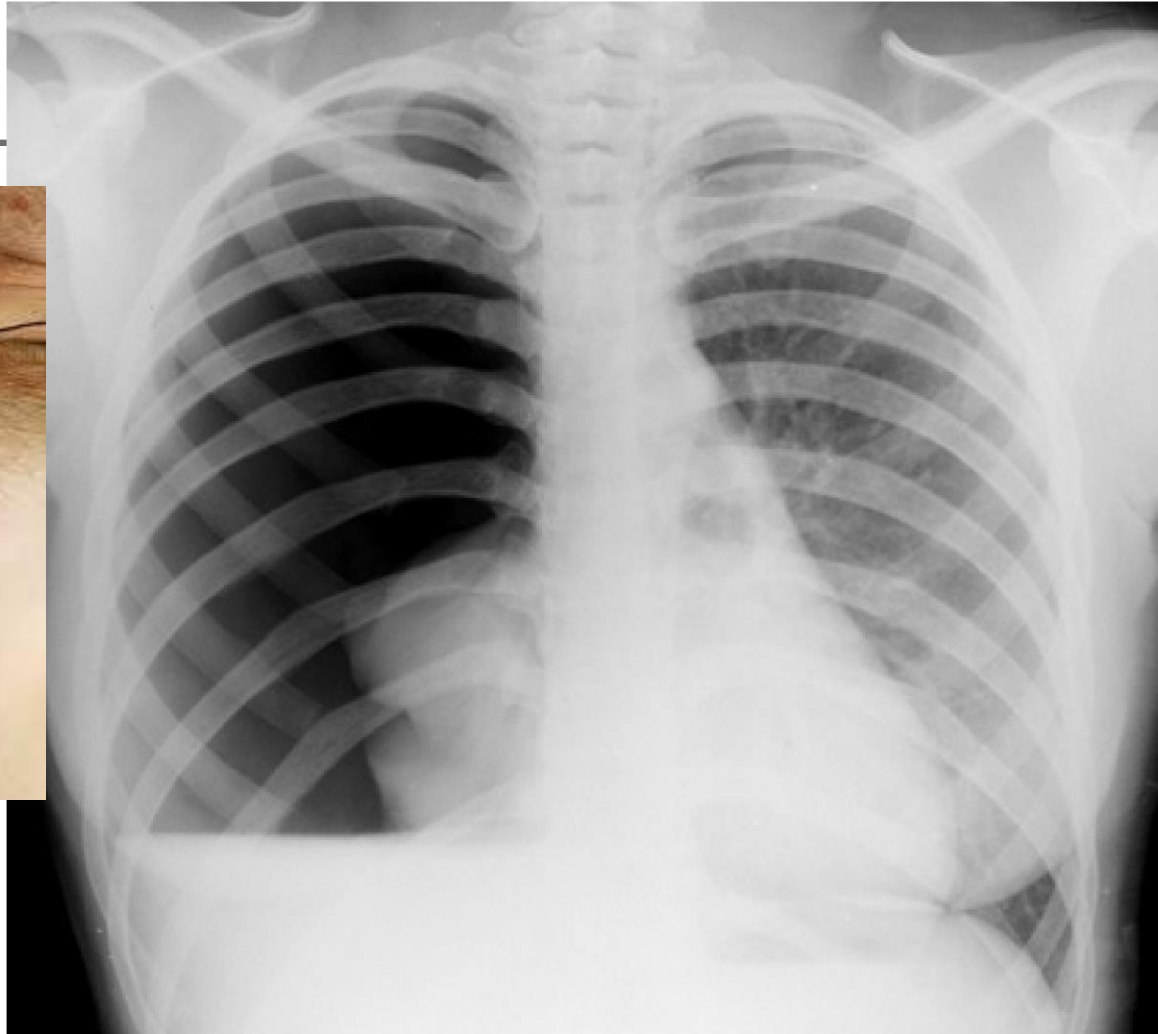
14. Hemothorax (white)

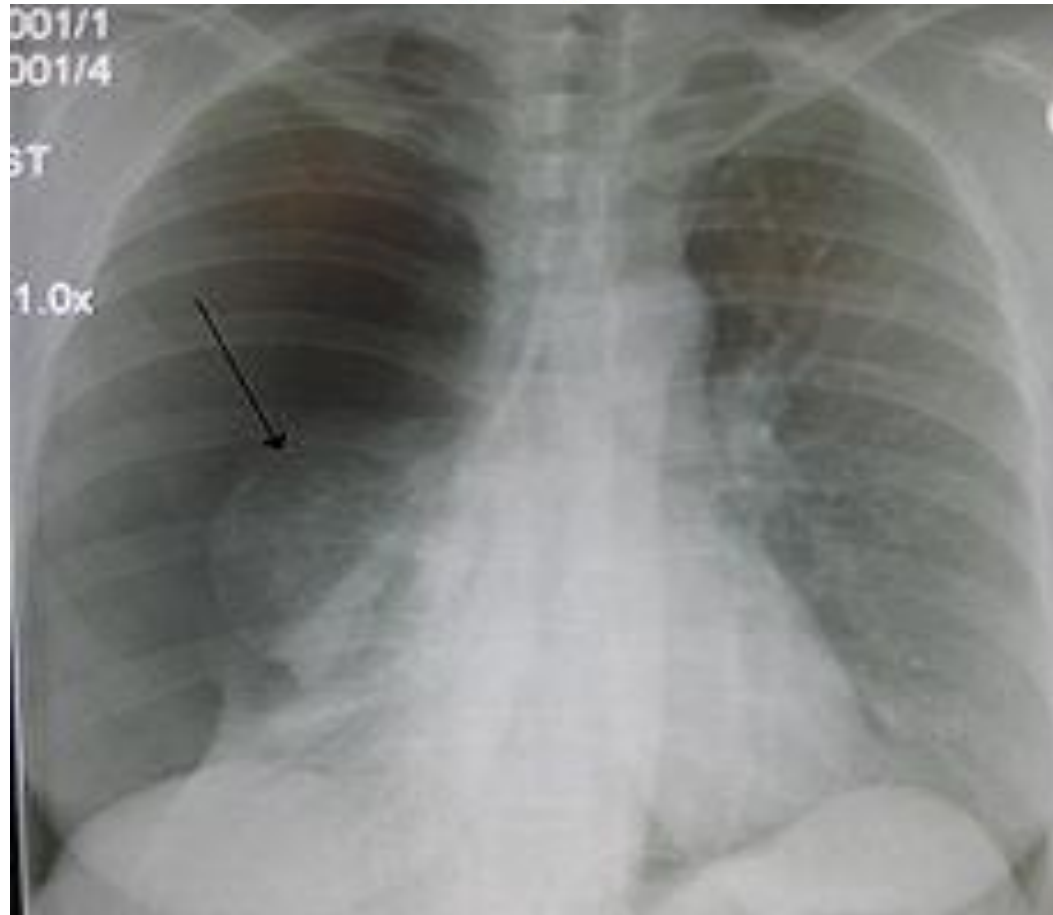
- Accumulation of BLOOD in the pleural cavity
- Partial or total collapse of lung tissue
- Chest pain
- Affected lung displaced from chest wall.
- No lung markings seen in region of collapsed lung.
- Lat Decubitus with affected side on top (if patient cannot stand)

15. Pneumothorax

- Air in the pleural cavity resulting from trauma & can cause lung collapse.
- PA thorax (erect) on inspiration
- PA thorax (erect) on expiration (+5kVp)
- Lateral (trauma side nearest film)
- Intra-pleural pressure $\uparrow$ during expiration press lungs together to demonstrate pneumothorax more clearly.

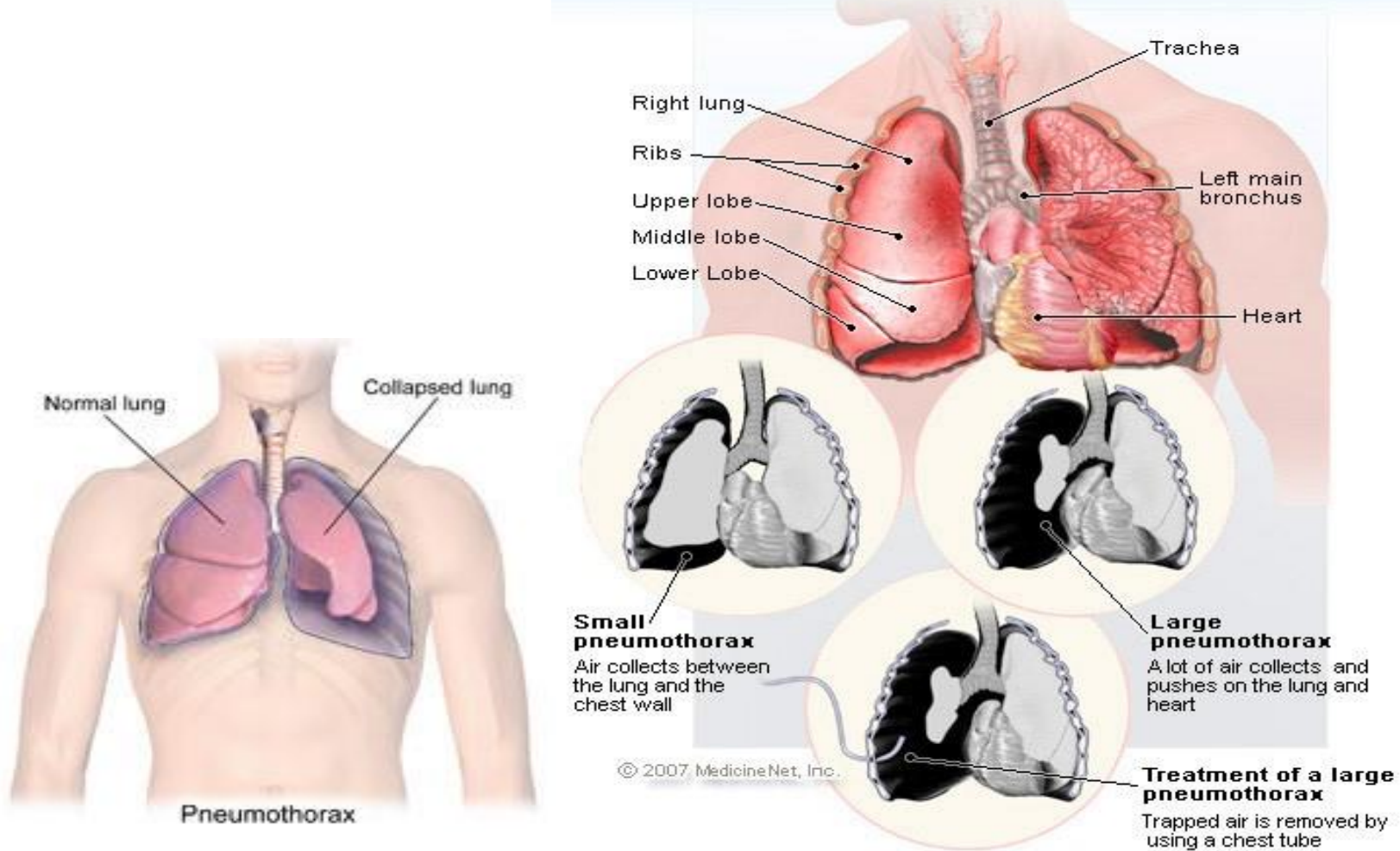
Pneumothorax (black) right- no lung markings





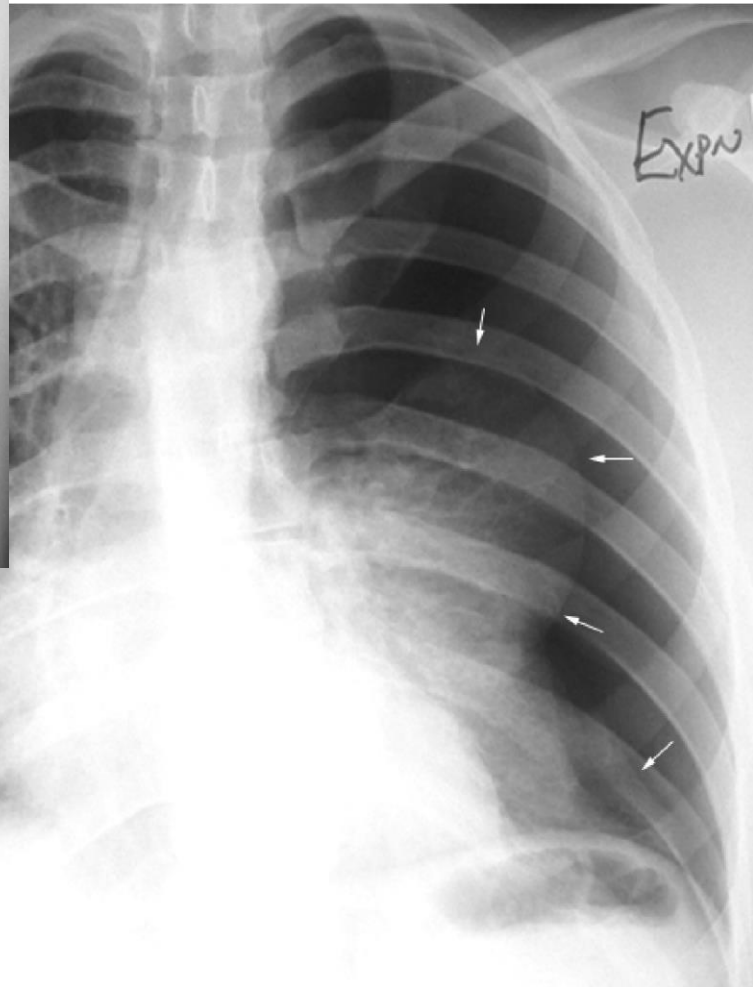
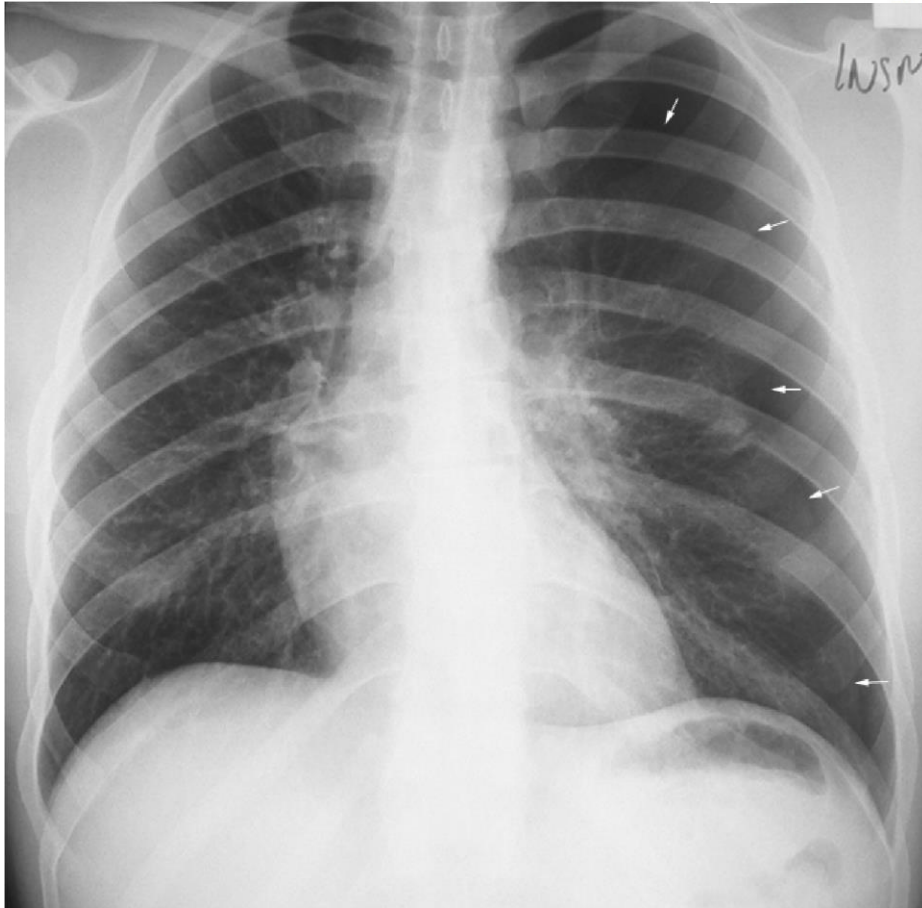
Right-sided spontaneous pneumothorax (left in the image). An arrow indicating the edge of the collapsed lung.

Pneumothorax



16. PNEUMOTHORAX (black)

- Accumulation of air in the pleural cavity
- Partial or total collapse of lung tissue
- Chest pain
- Affected lung displaced from chest wall.
- No lung markings seen in region of collapsed lung.
- PA on inspiration, PA on expiration (why?) and Lat (side of pathology)
- Lat Decubitus with affected side on top (if patient cannot stand)



Commonly employed radiographic protocol for pneumothorax detection is to perform inspiration and expiration PA/AP erect chest radiography. It is noteworthy that the expiration image can be useful for detection because the pneumothorax is likely to increase size. The inspiration image is required for measurement of the pneumothorax i.e. sizing

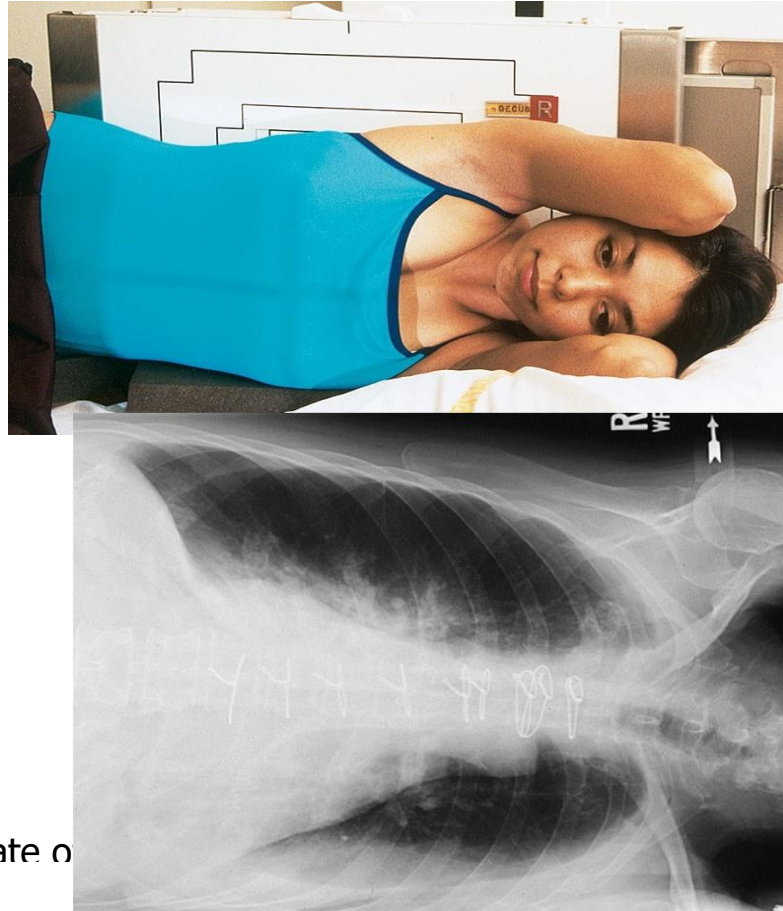
17. Left / Right Lateral Decubitus

- For air-fluid levels (result in AP or PA)
- Pt on L/R side, arms above head, ant/post aspect in contact with IR, anatomical planes correct, knees bent.
- Centre to middle of the ant/post aspect of thorax to the middle of the IR
- CR: horizontal & $\perp$ to the IR

18. Left Lateral Decubitus (AP)

Special

- AP supine or semierect
- Lat decub (AP)



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Let us revise.

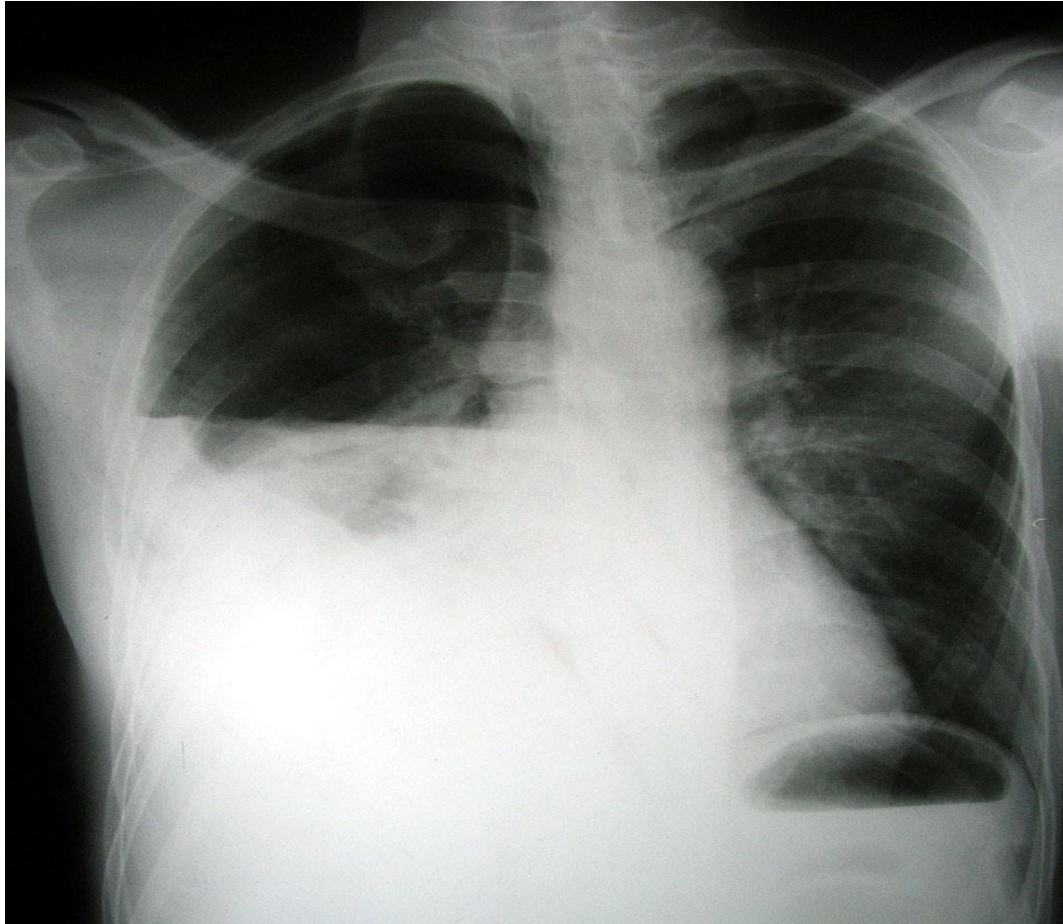
- Pneumo-thorax- air in pleural cavity

Lat Decubitus with affected side on top (if patient cannot stand)

- Hemo-pneumo thorax – blood & air in pleural cavity
- Same projections as pneumothorax
- Hemo-thorax – blood in pleural cavity
- Projections as for demonstration of fluid levels

Lat Decubitus with affected side below (if patient cannot stand)

19. Pneumohemothorax



20. Lung Apices

- Indications:
- Lesions in the lung apices
- Tuberculosis
- AP Axial Projection (lordotic position)
- To project clavicles away from the apices
- 24 x 30 cm cassette (crosswise)
- 180 cm FFD
- Suspended inspiration

21. AP Lordotic

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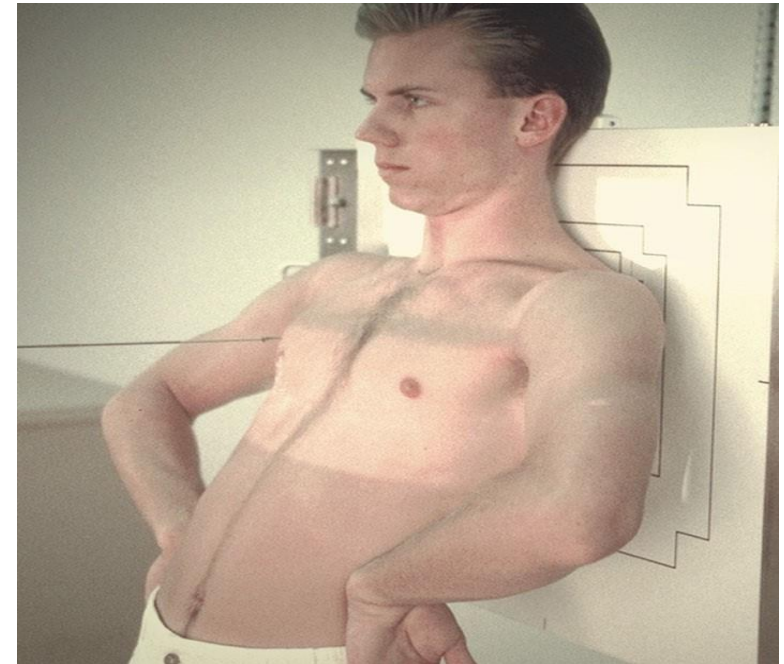
affiliate of Elsevier

- Special
- AP supine or Semi-erect
 - Lat decub (AP)
 - AP lordotic

Horizontal CR to midsternum

Inc.

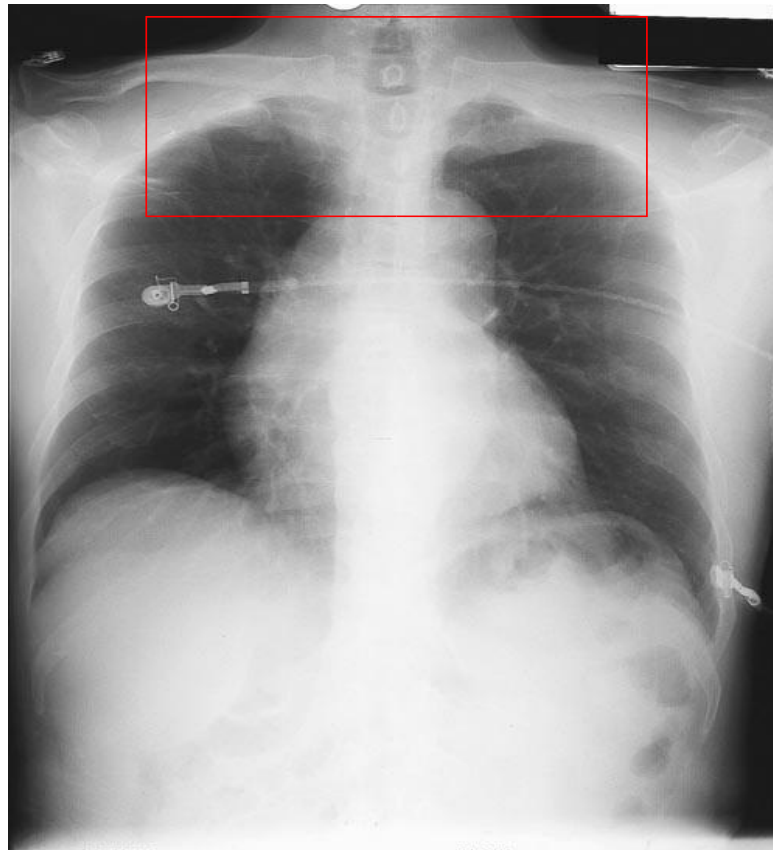
35



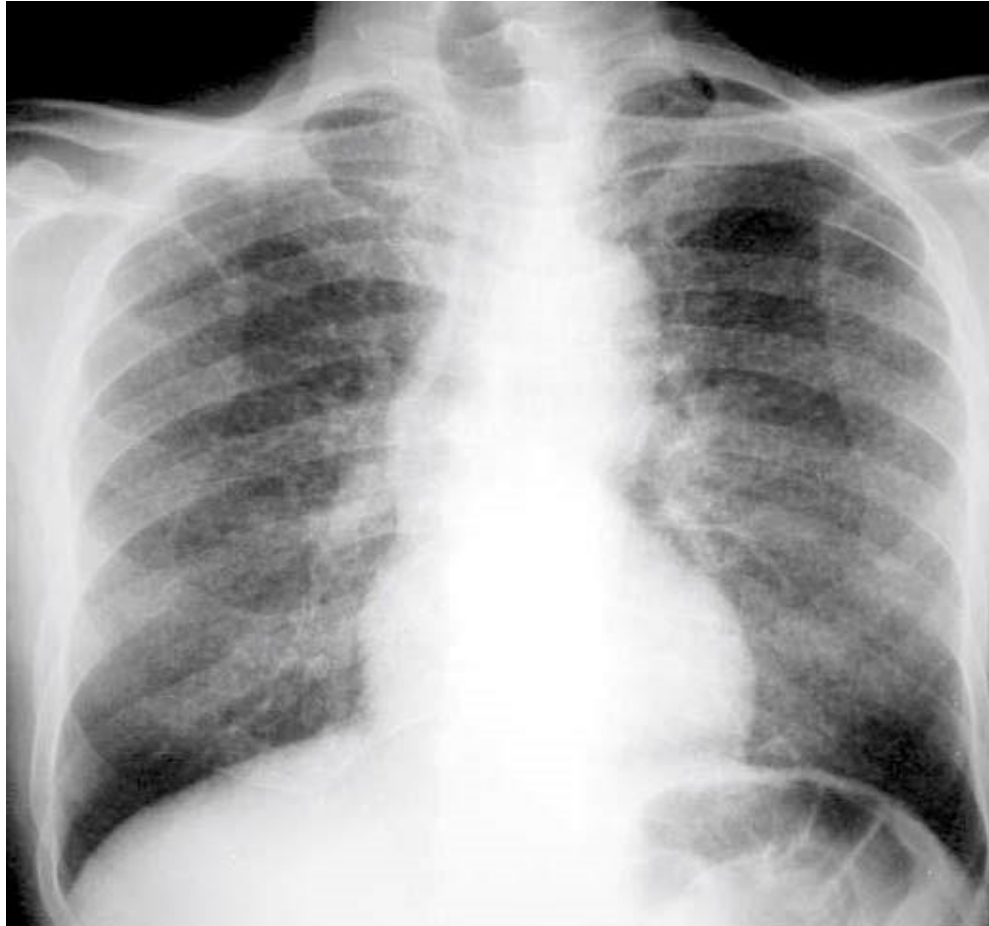
Lung Apices cont.

- Pt erect with post aspect against bucky.
- Step $\frac{1}{2}$ meter forward
- Lean backwards $30-45^\circ$ with post aspect of shoulders & neck on bucky
- Shoulders at same level
- Centre on MSP just inferior of clavicles to middle of the IR.
- CR: horizontal & $\perp$ to the IR

Lordotic Position (AP Axial Projection)



22. Miliary Tuberculosis



Tuberculosis
Left upper lobe
cavity



23. How to scan **JUST** for pathology (not criteria)

- Apex
- Scan both lungs
- Check costophrenic angles.

Plan and pattern

Appendix D – Areas of Interest

1. Introduction

This appendix consists of areas of interest on the area where pathology is present on the chest X-ray images that are being analysed by participants. These are areas that participants had to focus their attention on during the eye-tracking experiment. These areas are parts of the chest X-ray images that have pathologies. Pathologies present on the images are presented in Section 3.3.4. This appendix is divided into two sections, namely:

- AOIs on pre-training stimuli – These are the images that were analysed by experts and novices before training.
- AOIs on post-training stimuli – These are the images that were analysed by novices after training.

2. AOIs on pre-training stimuli

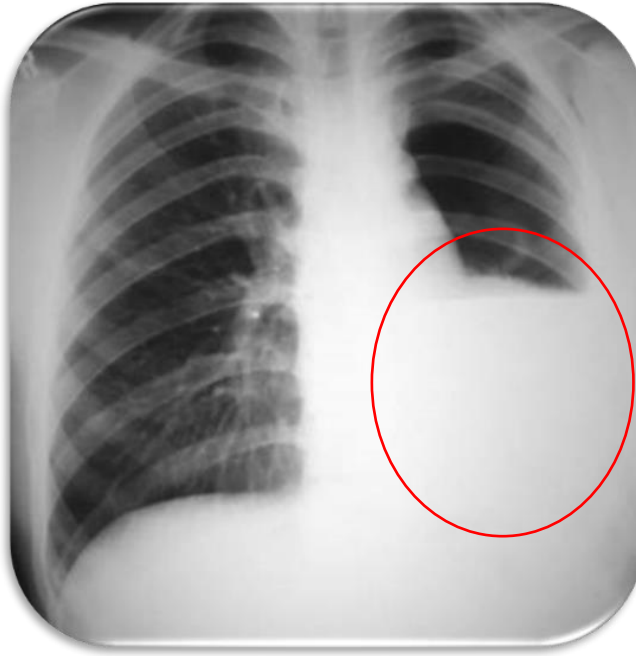


Figure 2.1: AOI on Pneumo-haemothorax X-ray image

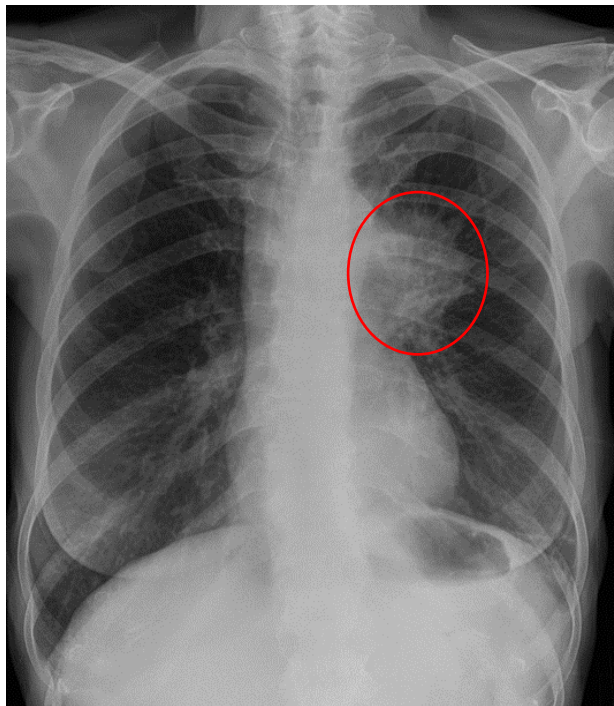


Figure 2.2: AOI on Lung Cancer X-ray image

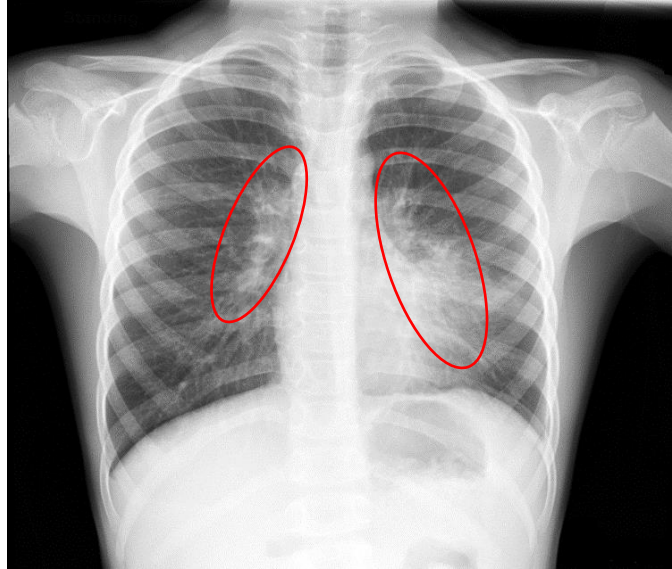


Figure 2.3: AOI on Pneumonia X-ray image

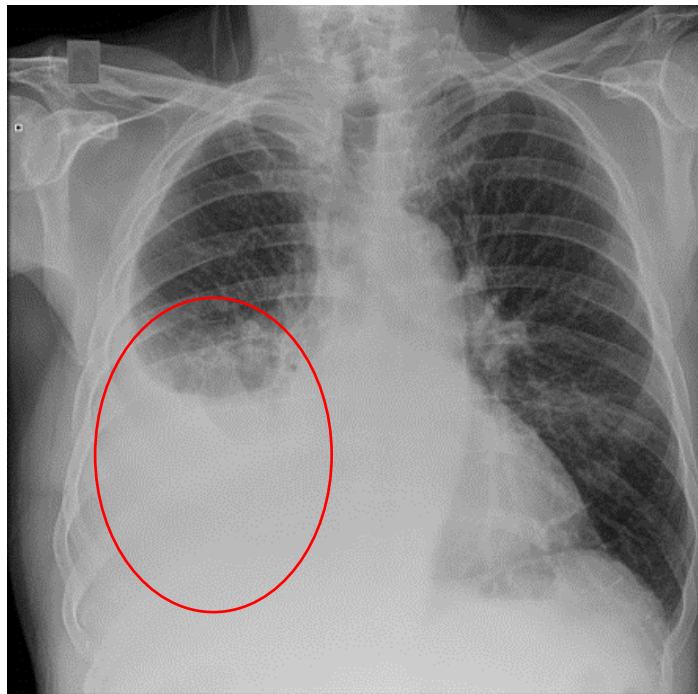


Figure 2.4: AOI on Pleural effusion X-ray image

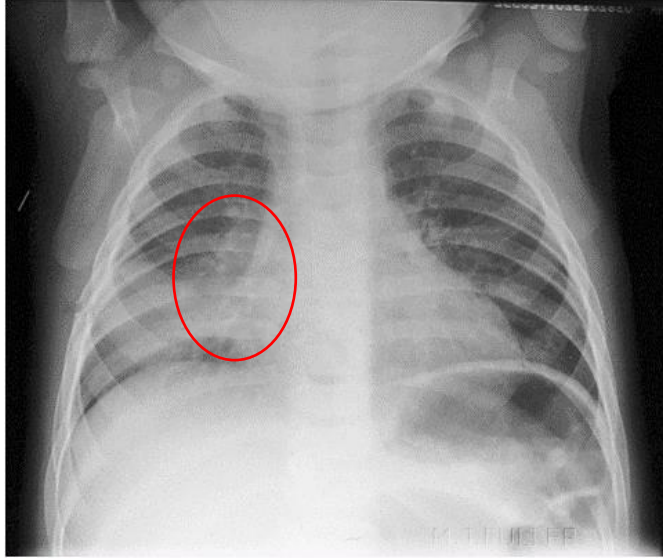


Figure 2.5: AOI on Pneumonia X-ray image

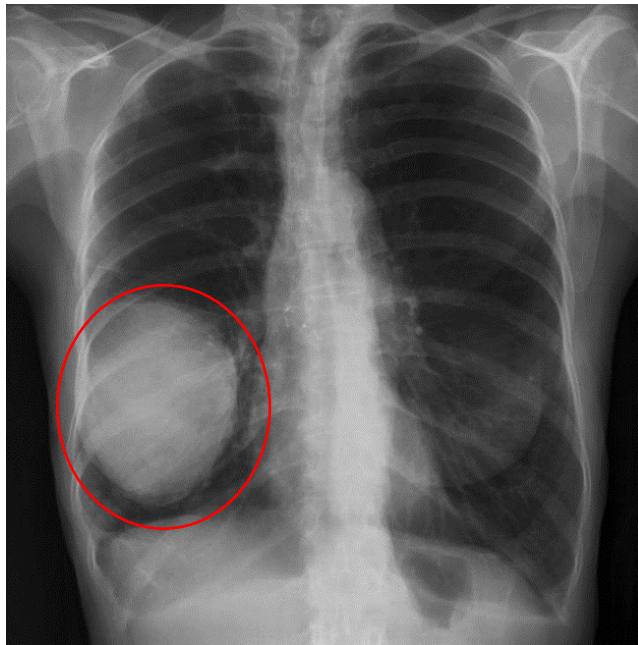


Figure 2.6: AOI on Lung Cancer X-ray image



Figure 2.7: AOI on Pneumothorax X-ray image



Figure 2.8: AOI on Pneumonia X-ray image

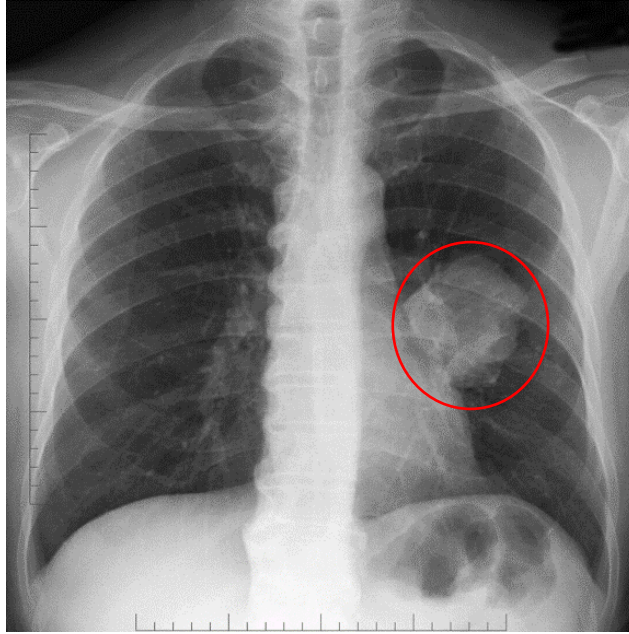


Figure 2.9: AOI on Lung Cancer X-ray image

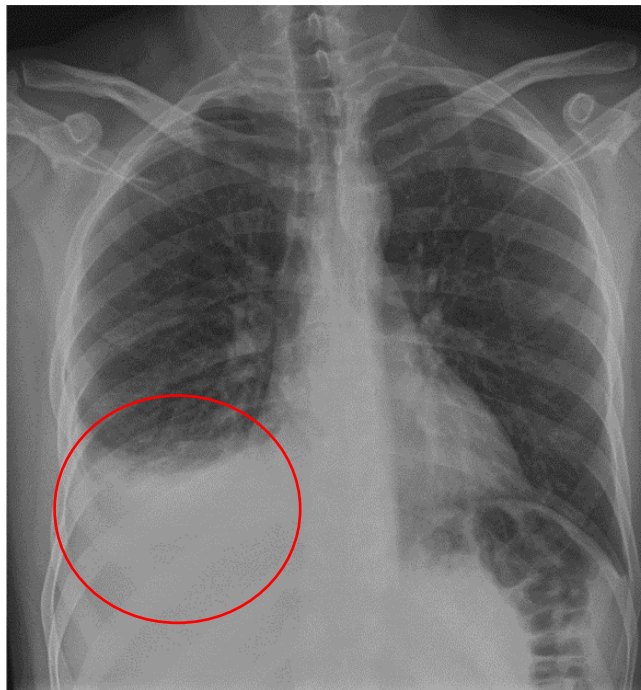


Figure 2.10: AOI on Pleural Effusion X-ray image

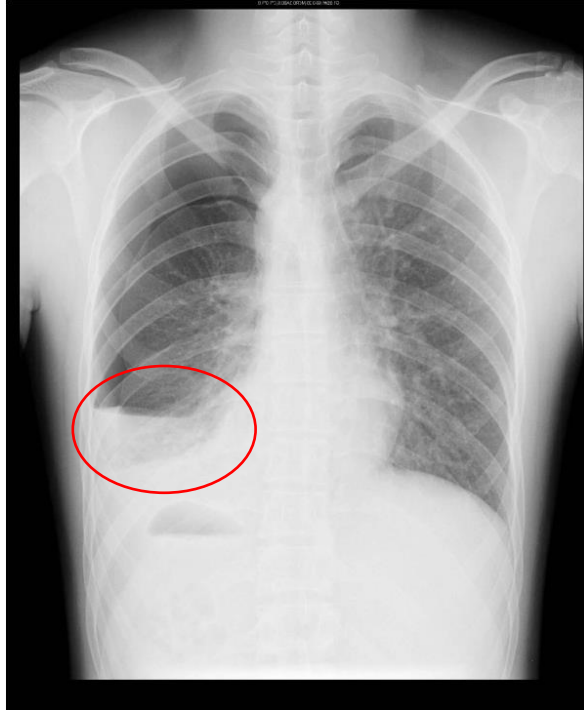


Figure 2.11: AOI on Pnemo-haemothorax X-ray image

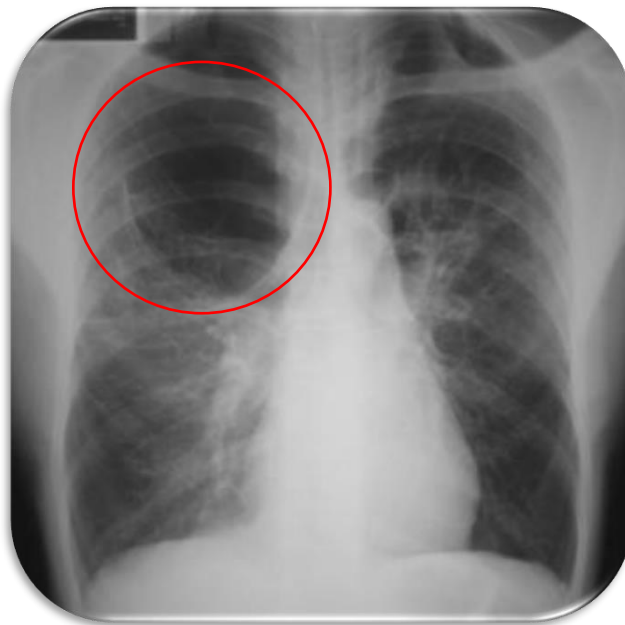


Figure 2.12: AOI on Pneumothorax X-ray image

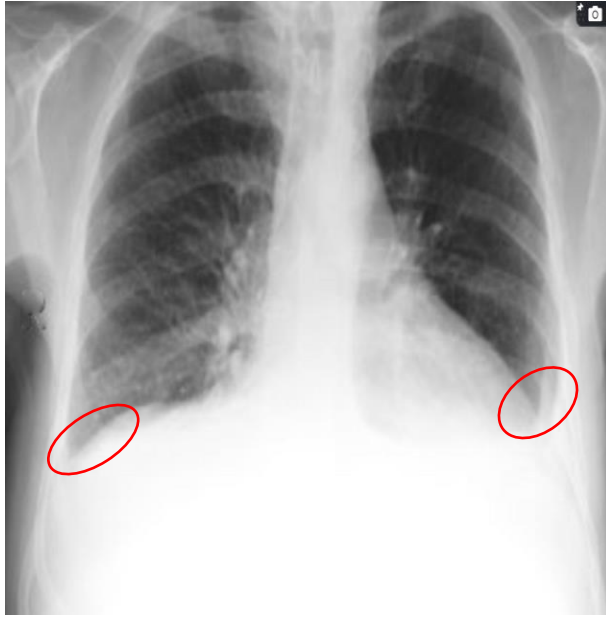


Figure 2.13: AOI on Pleural Effusion X-ray image

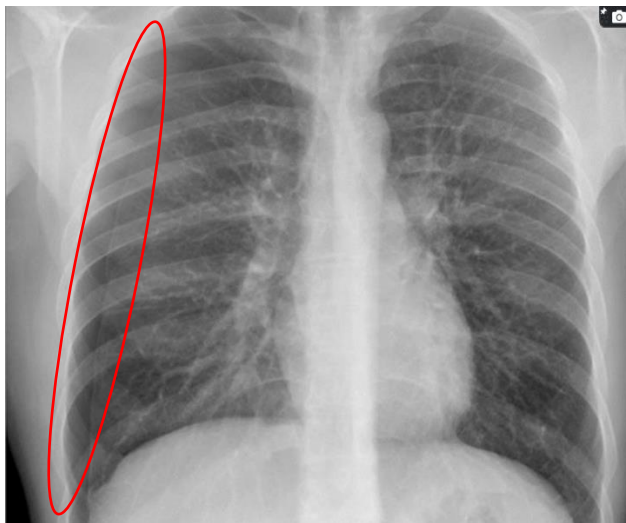


Figure 2.14: AOI on Pneumothorax X-ray image

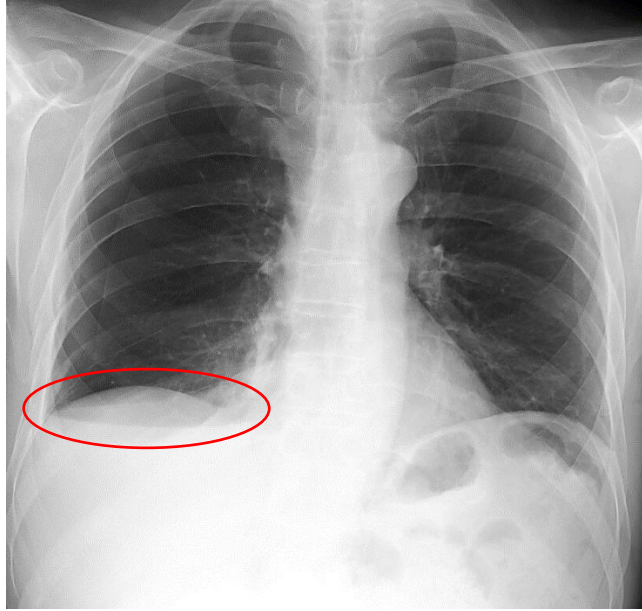


Figure 2.15: AOI on Pneumo-haemothorax X-ray image

3. AOIs on post-training stimuli

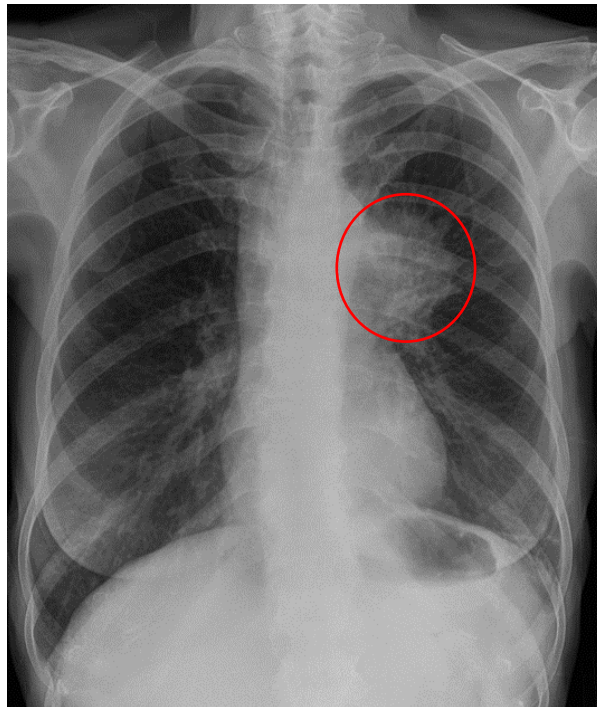


Figure 3.1: AOI on Lung Cancer X-ray image

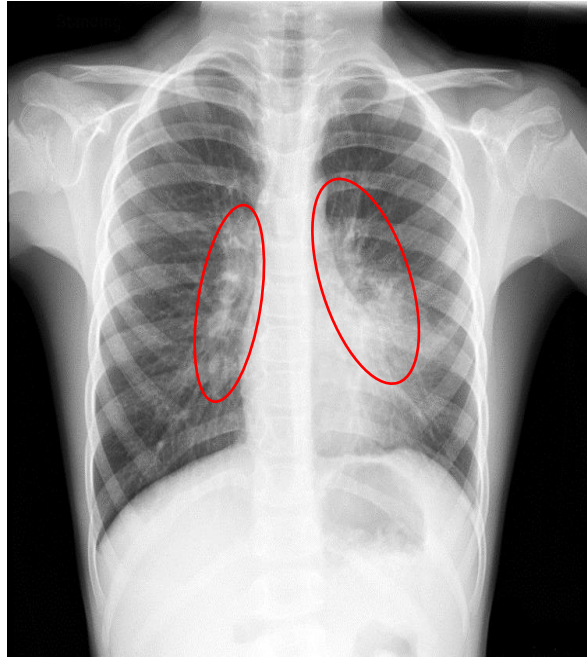


Figure 3.2: AOI on Pneumonia X-ray image

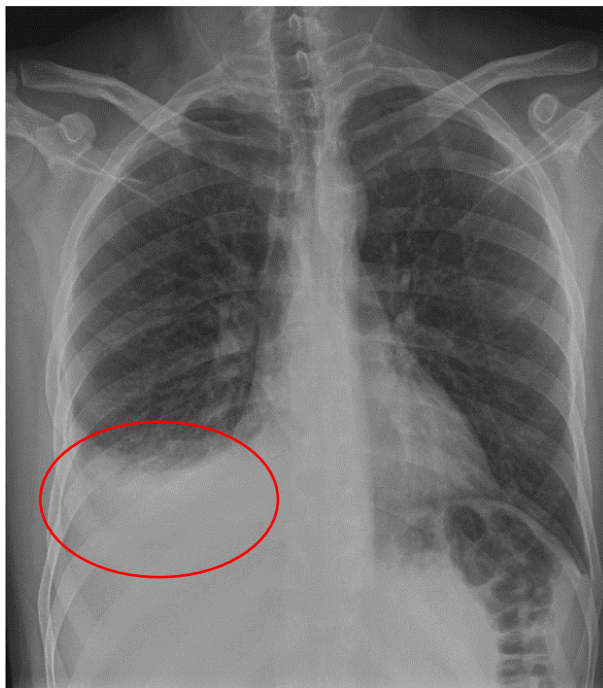


Figure 3.3: AOI on Pleural Effusion X-ray image

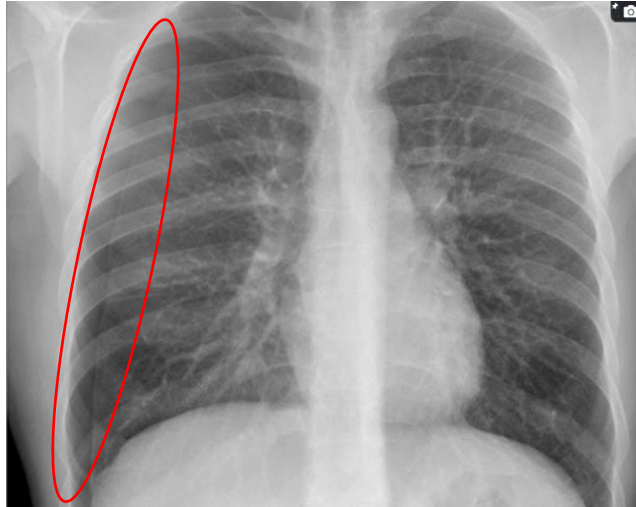


Figure 3.4: AOI on Pneumothorax X-ray image

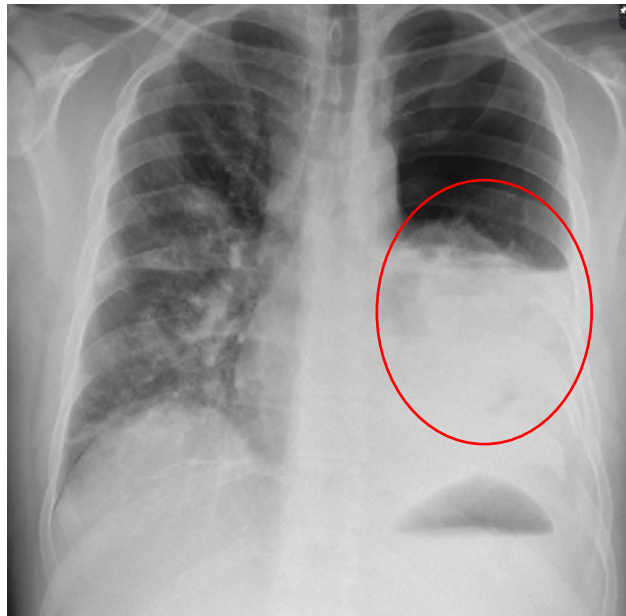


Figure 3.5: AOI on Pneumo-haemothorax X-ray image

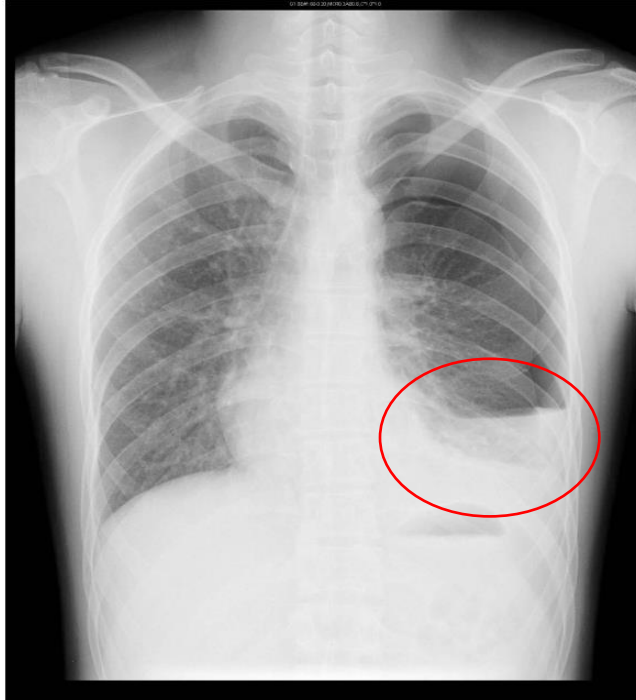


Figure 3.6: AOI on Pneumo-haemothorax X-ray image

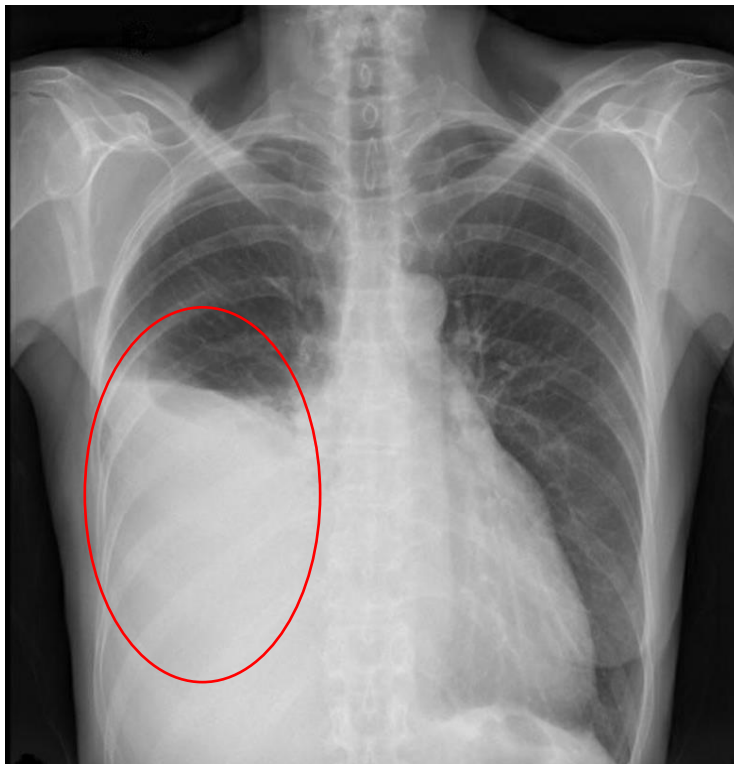


Figure 3.7: AOI on Pleural Effusion X-ray image

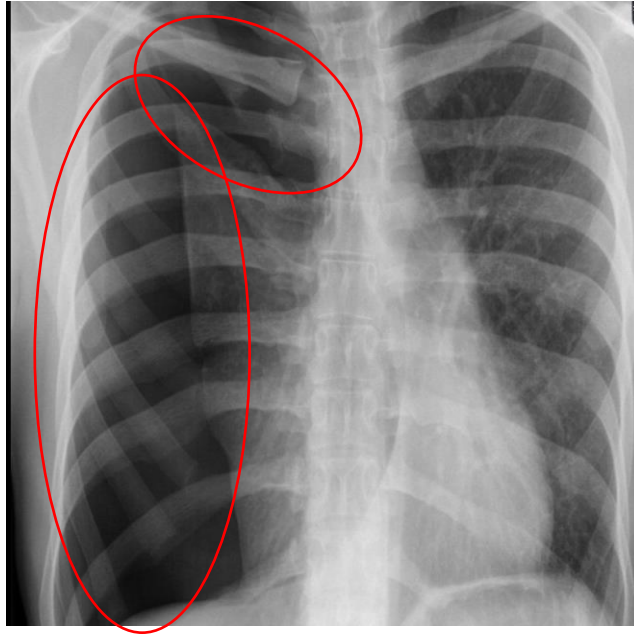


Figure 3.8: AOI on Pneumothorax X-ray image

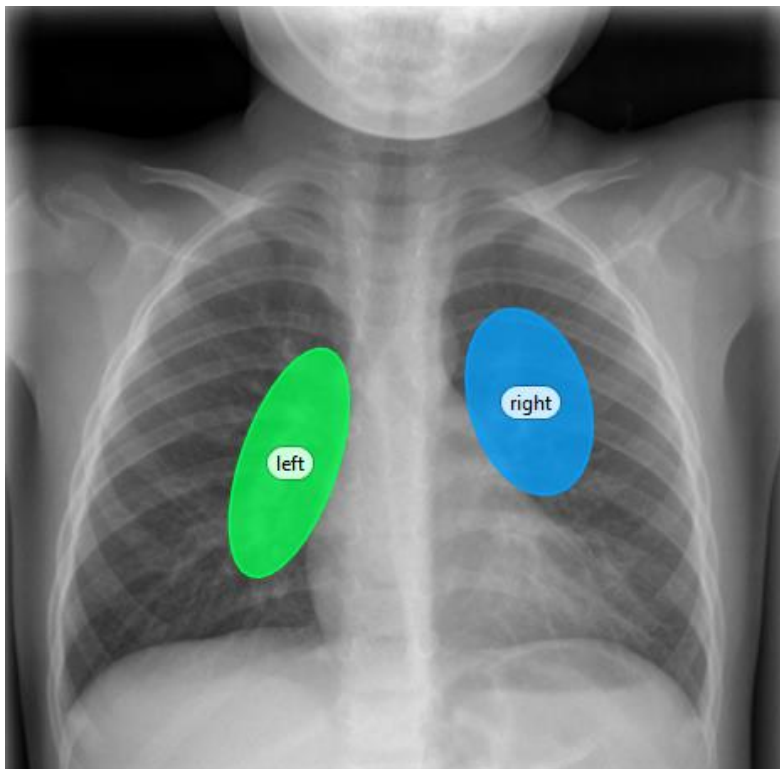


Figure 3.9: AOI on Pneumonia X-ray image

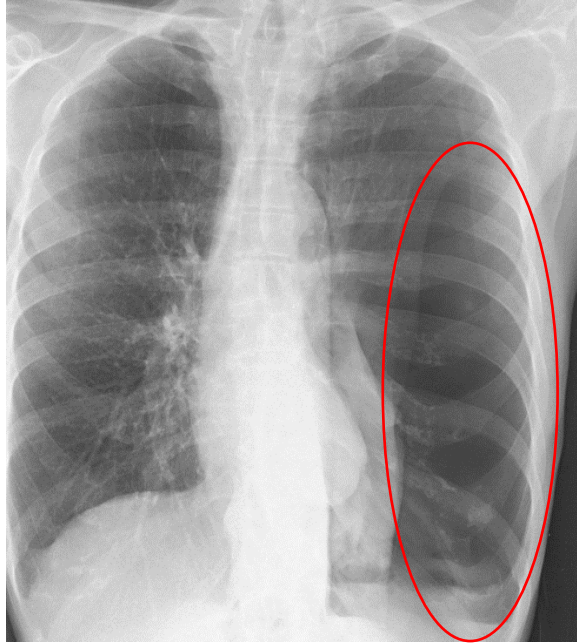


Figure 3.10: AOI on Pneumothorax X-ray image

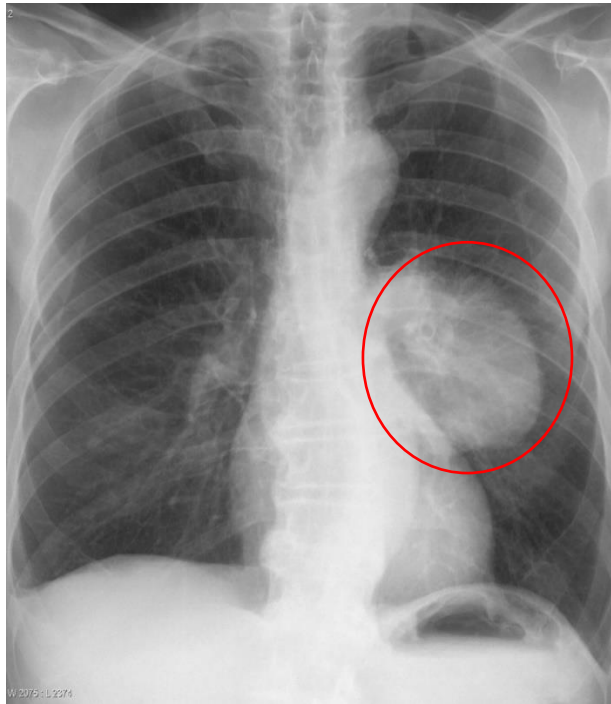


Figure 3.11: AOI on Lung Cancer X-ray image

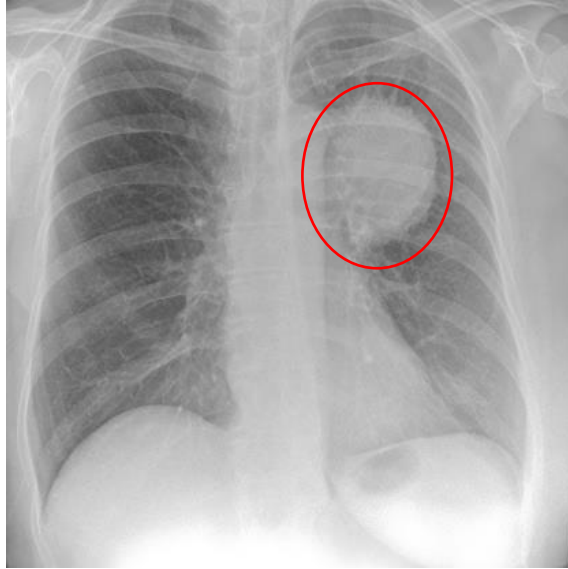


Figure 3.12: AOI on Lung Cancer X-ray image

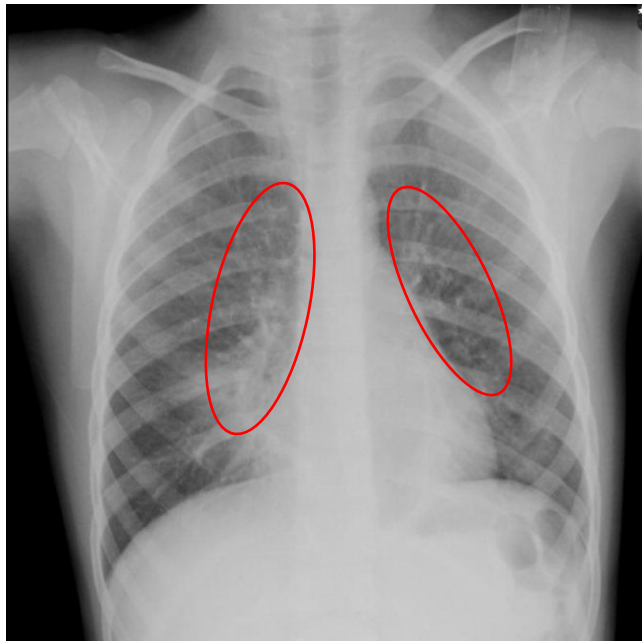


Figure 3.13: AOI on Pneumonia X-ray image

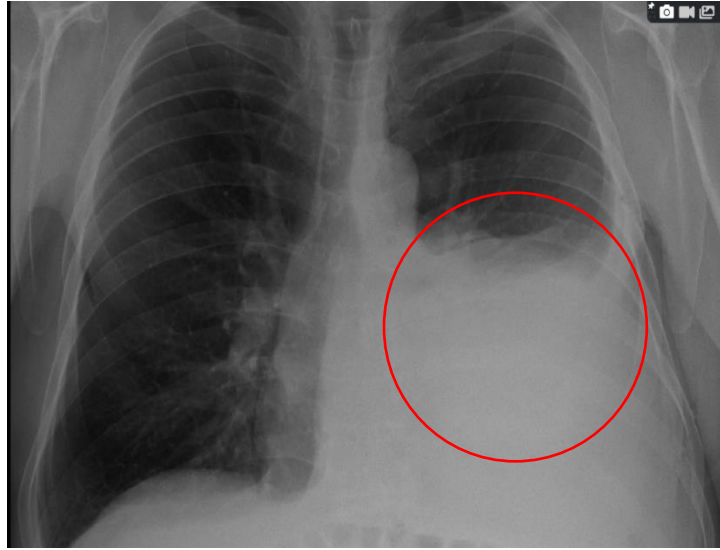


Figure 3.14: AOI on Pleural Effusion X-ray image

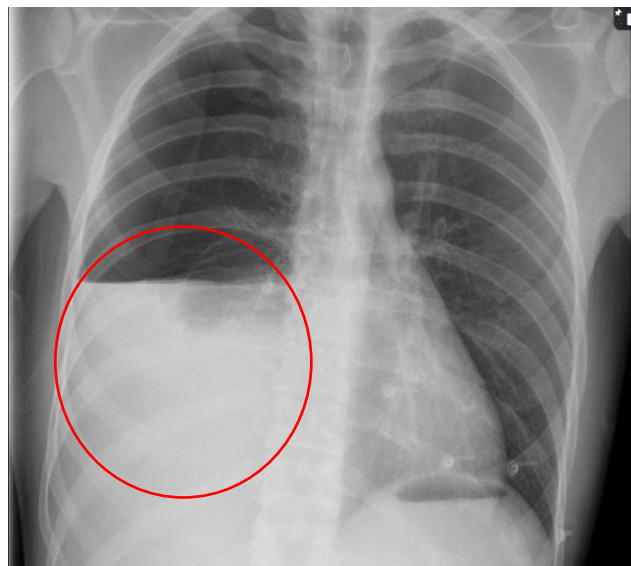


Figure 3.15: AOI on Pneumo-haemothorax X-ray image

Appendix E: Heat maps

1. Introduction

This appendix presents the heat maps that were gathered as participants analysed the chest X-ray images. Aggregated heat maps were generated from all novices' and from all experts' gaze behaviour and they were used to show the areas where the density of fixations was the highest. Heat maps use a colour scheme to show the total Duration of Fixations on various areas of a stimulus. Warm colours on the heat map such as red and yellow, show areas that received the most visual attention. The experts' heat maps are referenced in Section 3.3.6 and the novices' heat maps are referenced in Section 4.2.2.

This appendix is divided into three sections, namely:

- Novices' pre-training heat maps – aggregated heat maps gathered from 41 novices before training when analysing the images.
- Novices' post-training heat maps – aggregated heat maps gathered from 40 novices after training when analysing the images.
- Experts' heat maps – aggregated heat maps gathered from 23 experts when analysing the images.

2. Novices' pre-training heat maps

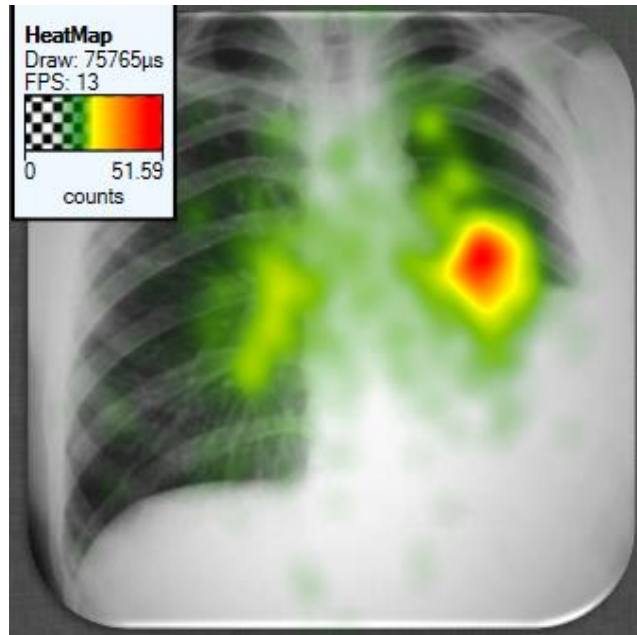


Figure 2.1: Heat map on Pneumo-haemothorax X-ray image (41 participants)

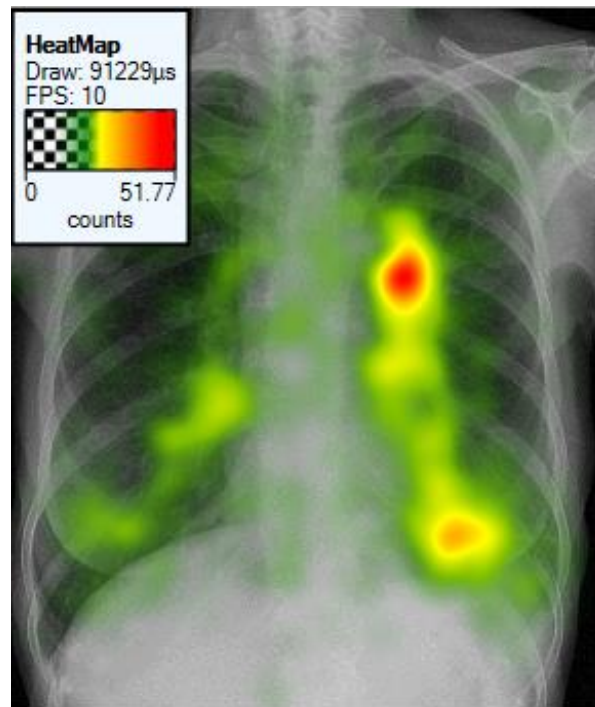


Figure 2.2: Heat map on Lung Cancer X-ray image (41 participants)

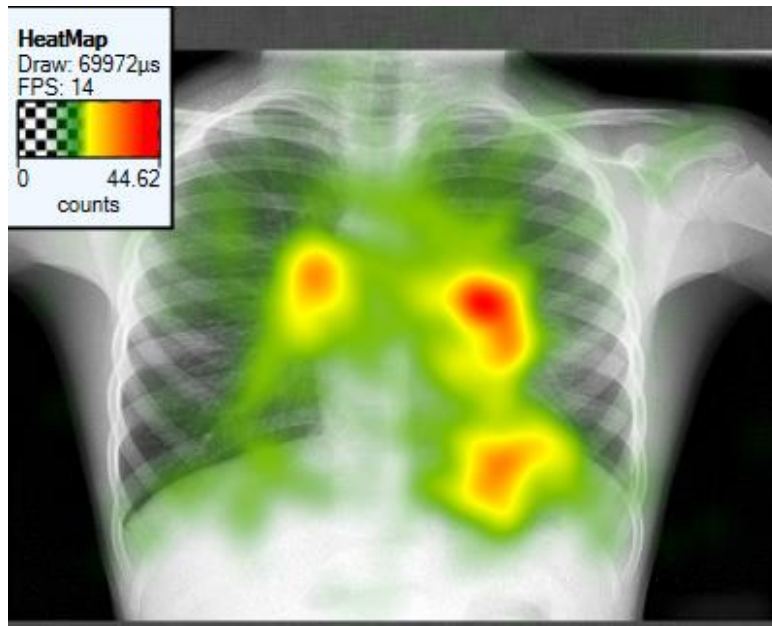


Figure 2.3: Heat map on Pneumonia X-ray image (41 participants)

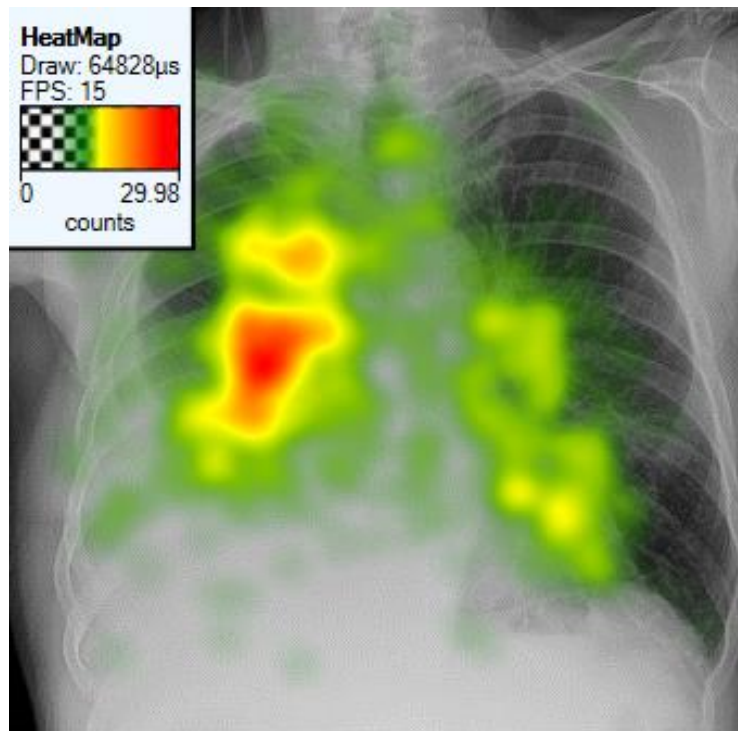


Figure 2.4: Heat map on Pleural Effusion X-ray image (41 participants)

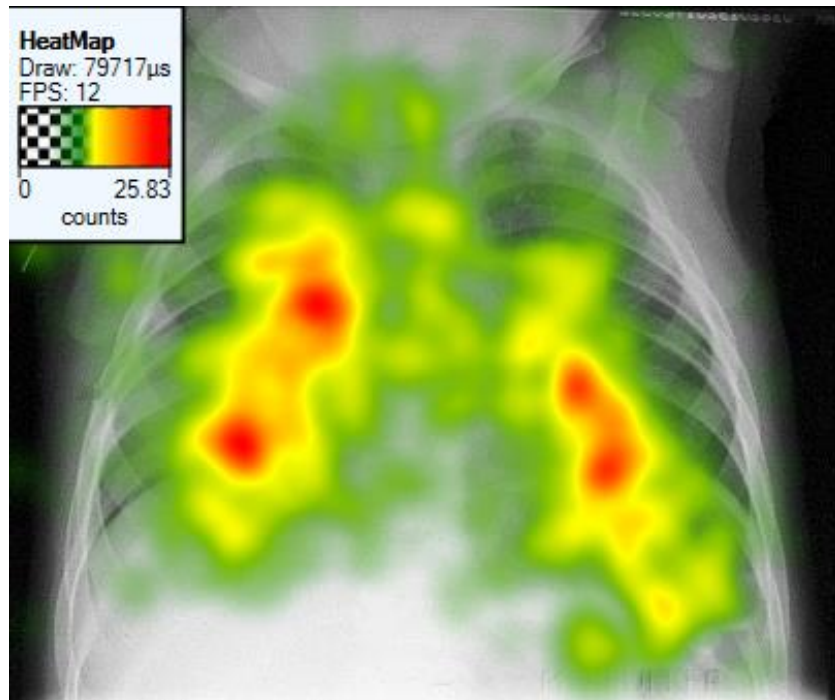


Figure 2.5: Heat map on Pneumonia X-ray image (41 participants)

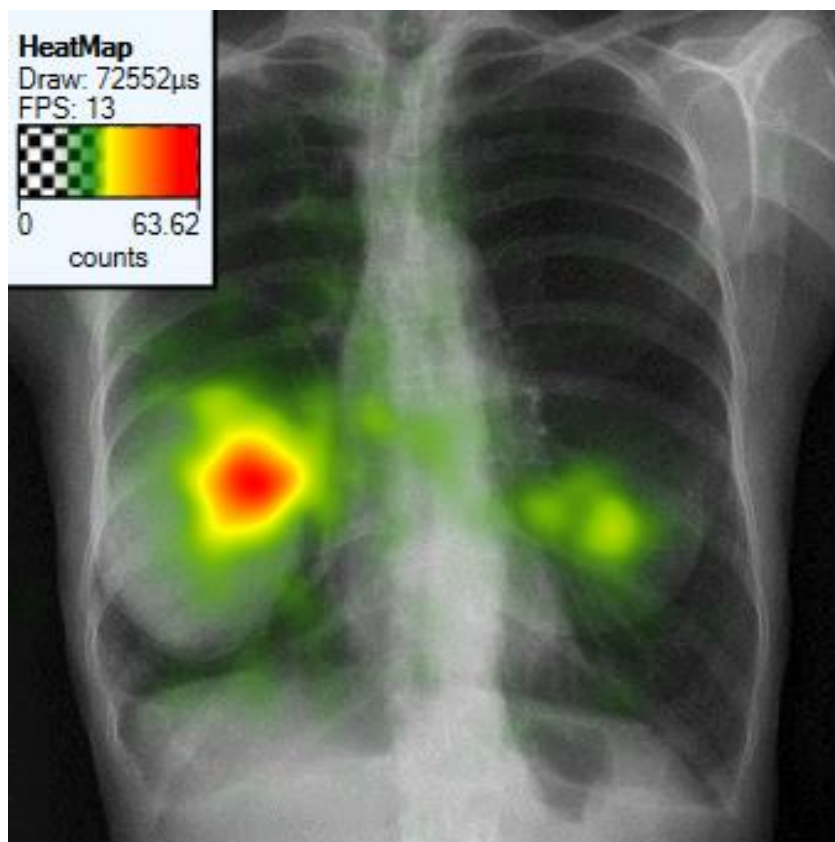


Figure 2.6: Heat map on Lung Cancer X-ray image (41 participants)

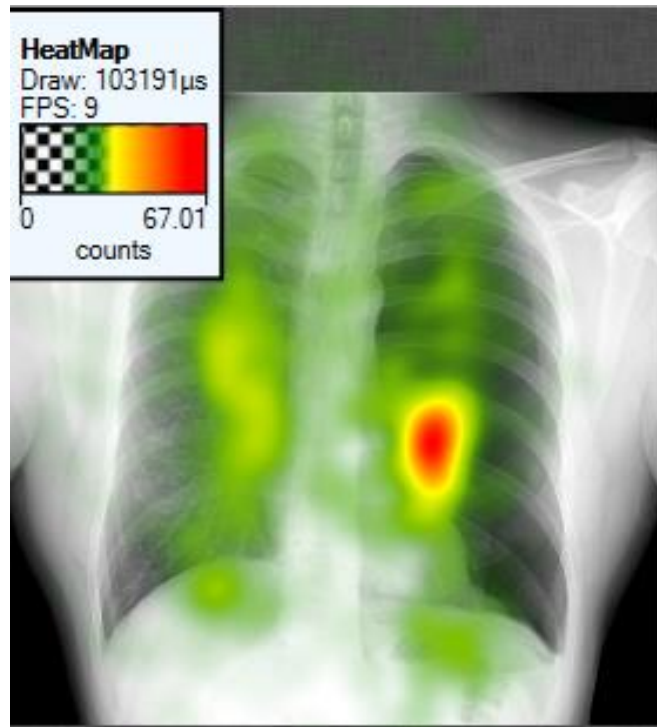


Figure 2.7: Heat map on Pneumothorax X-ray image (41 participants)

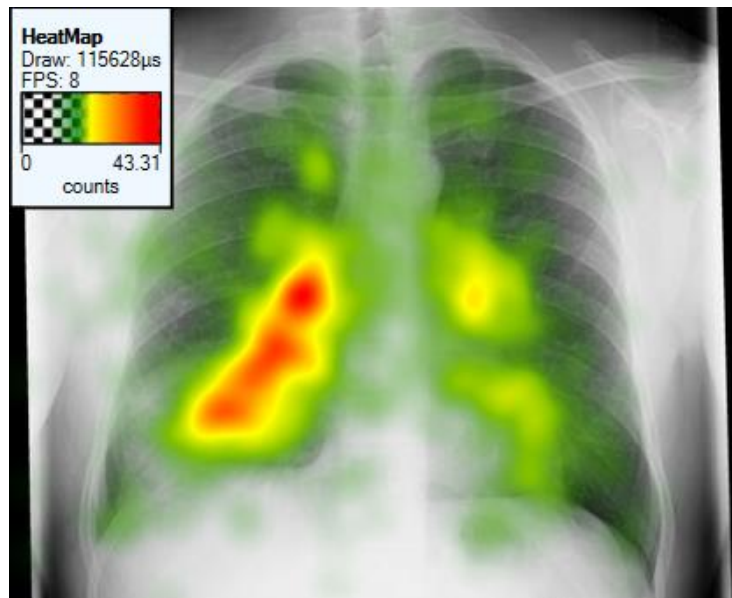


Figure 2.8: Heat map on Pneumonia X-ray image (41 participants)

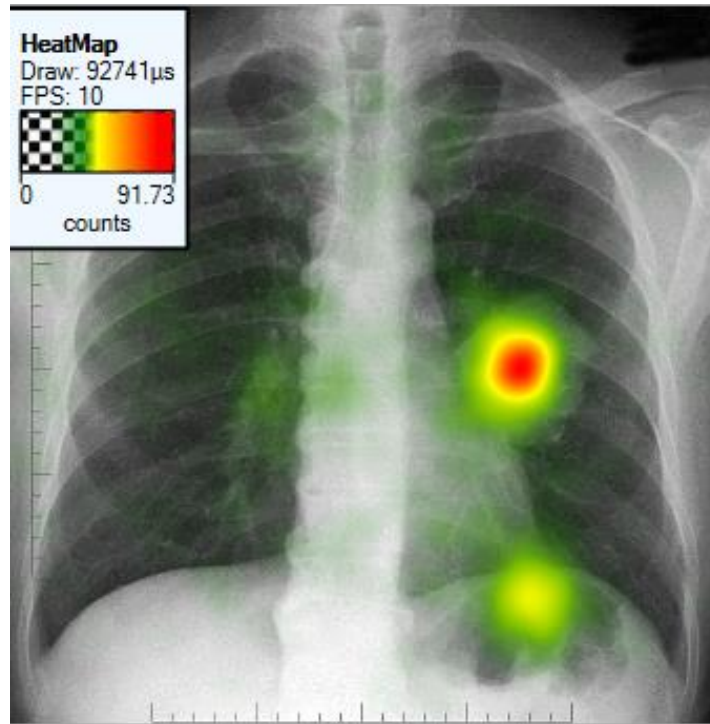


Figure 2.9: Heat map on Lung Cancer X-ray image (41 participants)

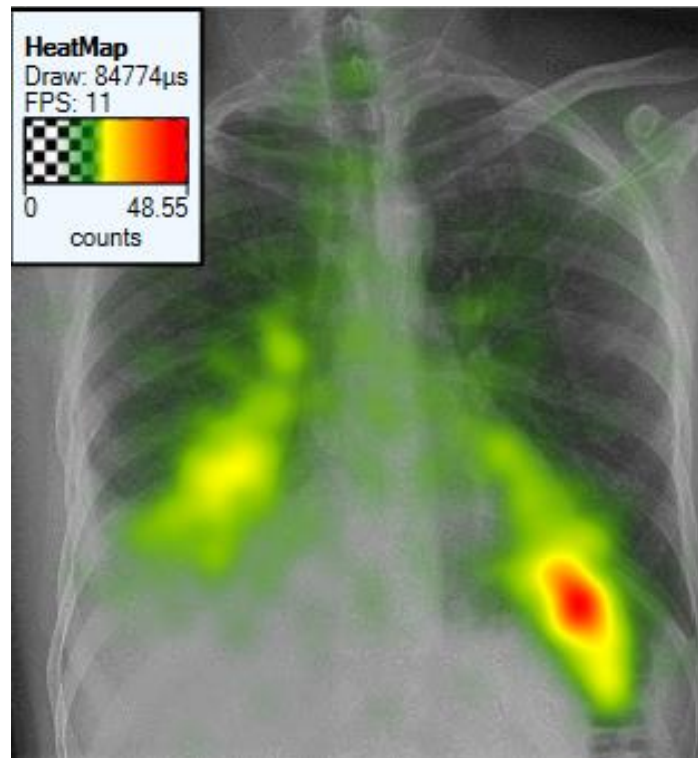


Figure 2.10: Heat map on Pleural Effusion X-ray image (41 participants)

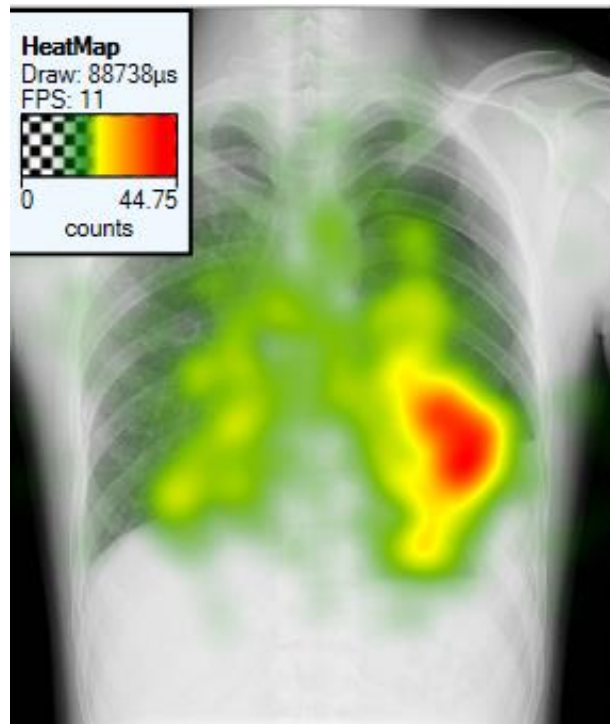


Figure 2.11: Heat map on Pneumo-haemothorax X-ray image (41 participants)

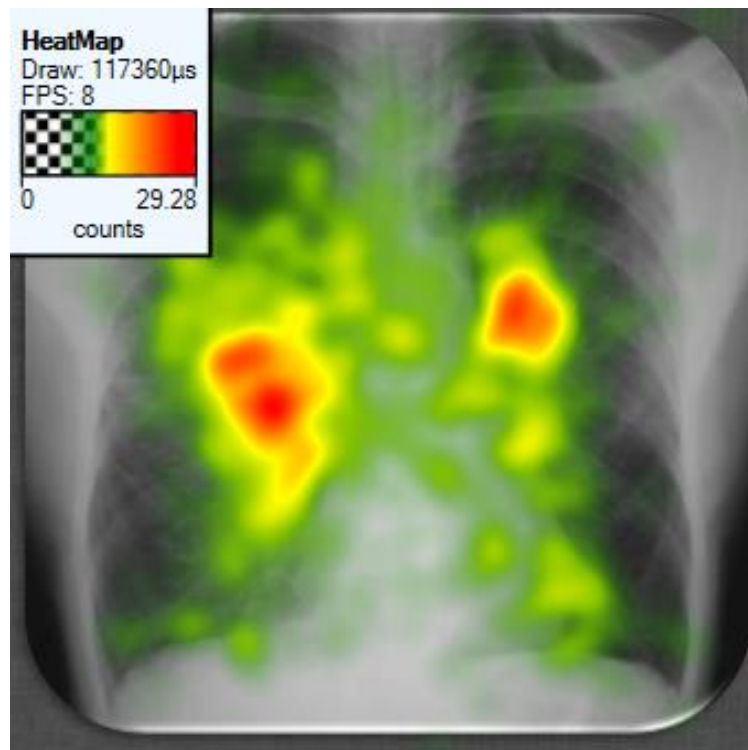


Figure 2.12: Heat map on Pneumothorax X-ray image (41 participants)

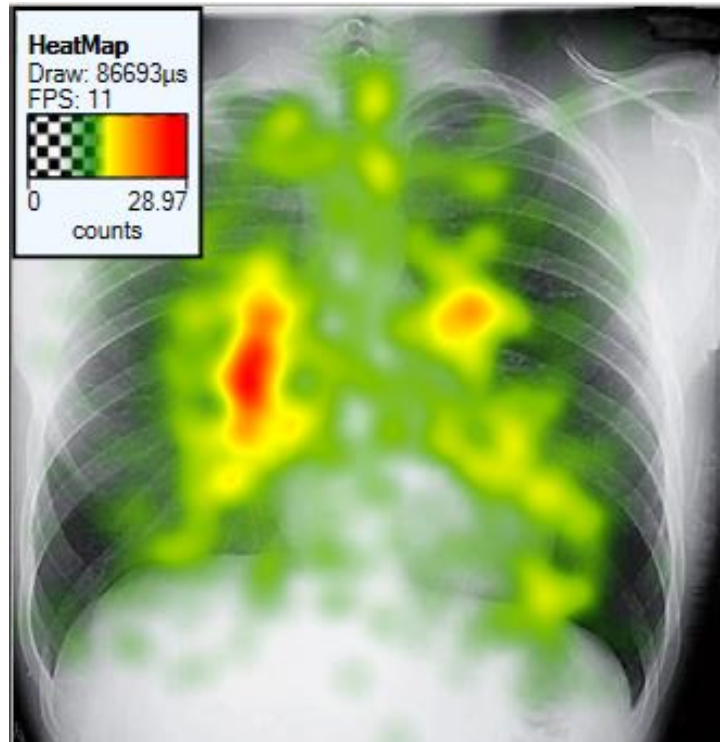


Figure 2.13: Heat map on Normal X-ray image (41 participants)

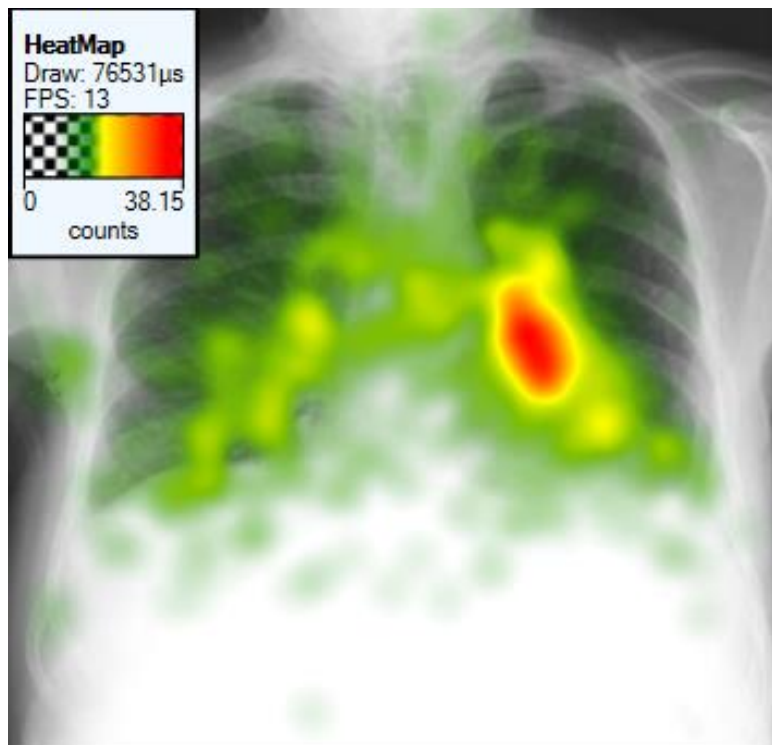


Figure 2.14: Heat map on Pleural Effusion X-ray image (41 participants)

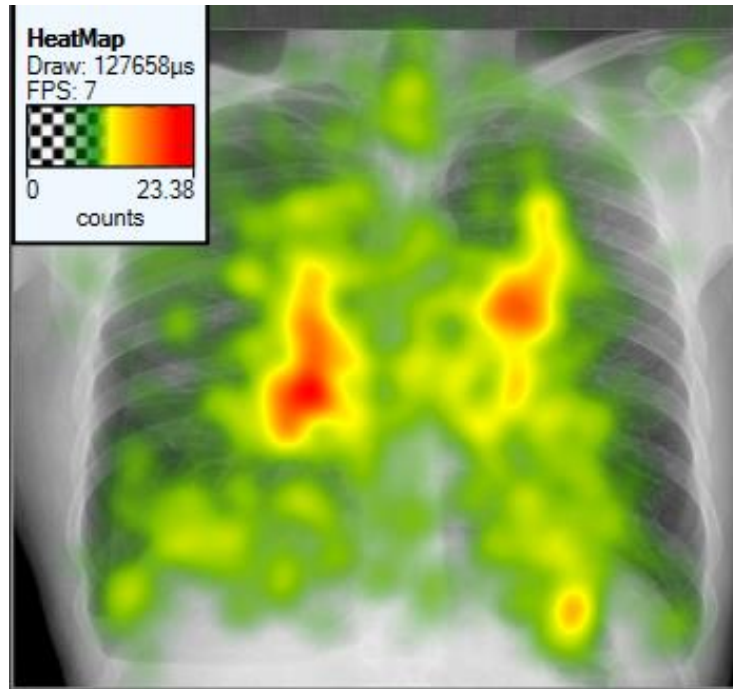


Figure 2.15: Heat map on Pneumothorax X-ray image (41 participants)

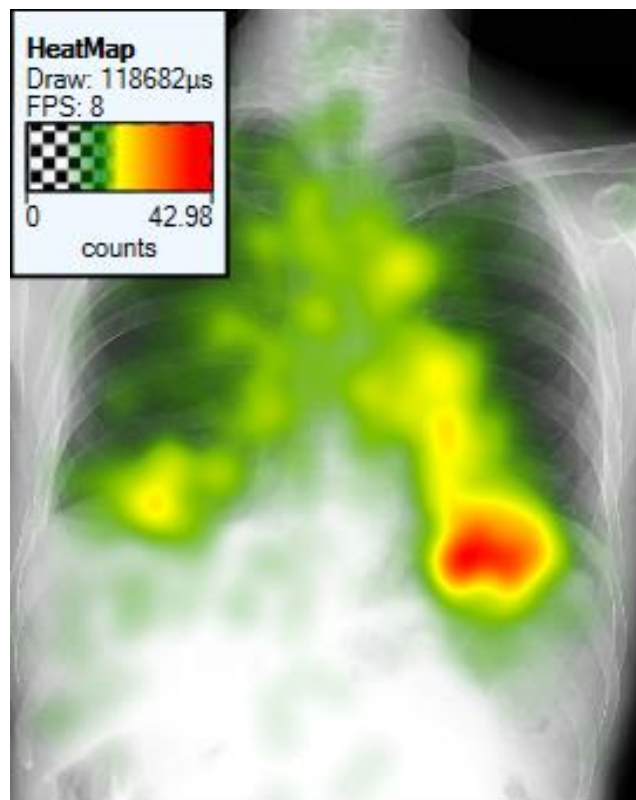


Figure 2.16: Heat map on Pneumo-haemothorax X-ray image (41 participants)

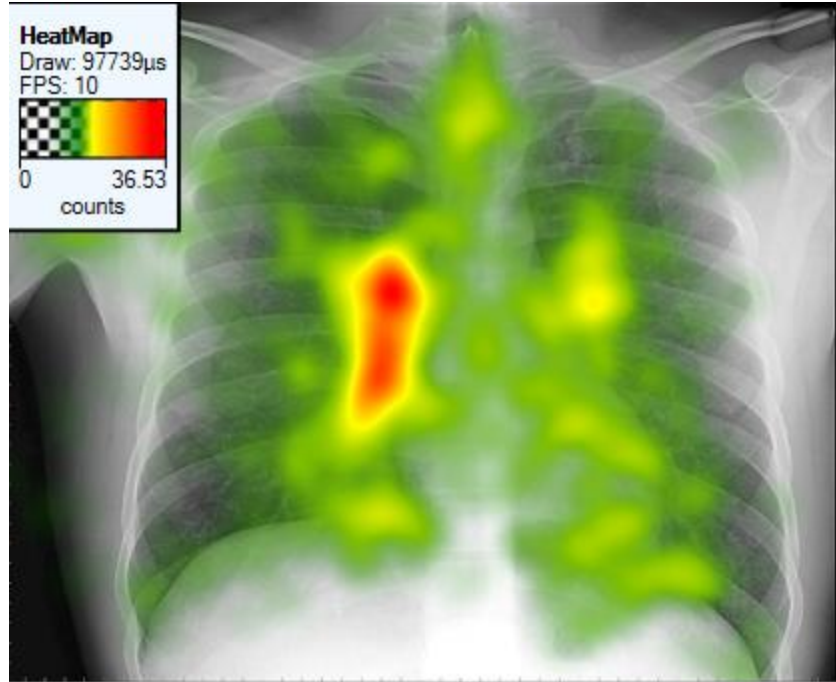


Figure 2.17: Heat map on Normal X-ray image (41 participants)

3. Novices' post-training heat maps

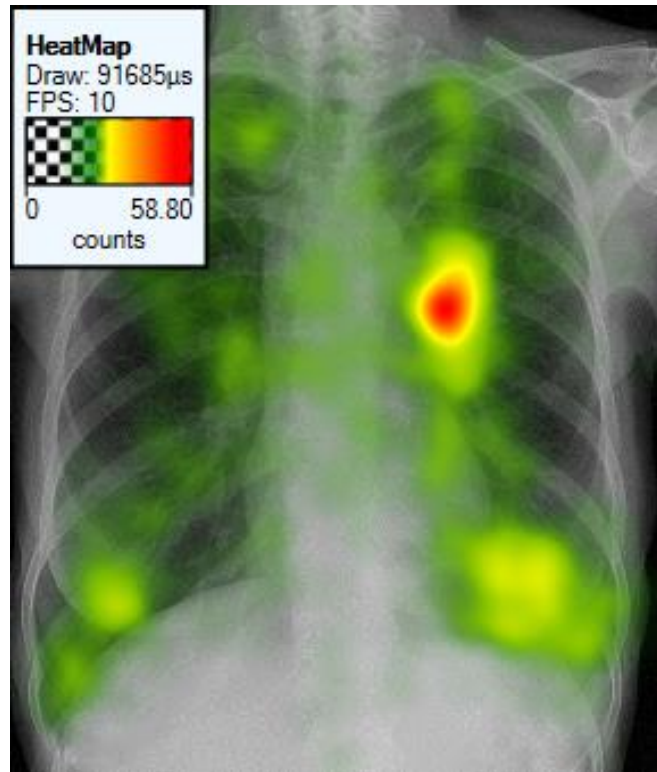


Figure 3.1: Heat map on Lung Cancer X-ray image (40 participants)

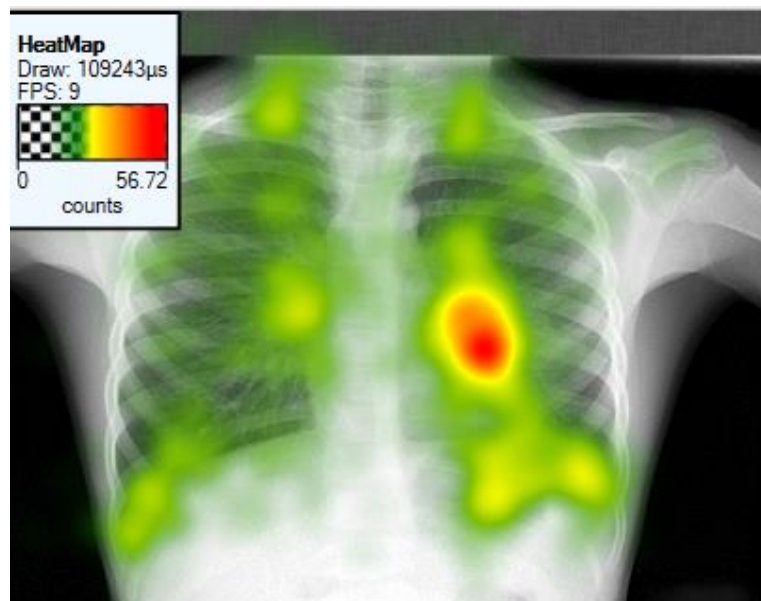


Figure 3.2: Heat map on Pneumonia X-ray image (40 participants)

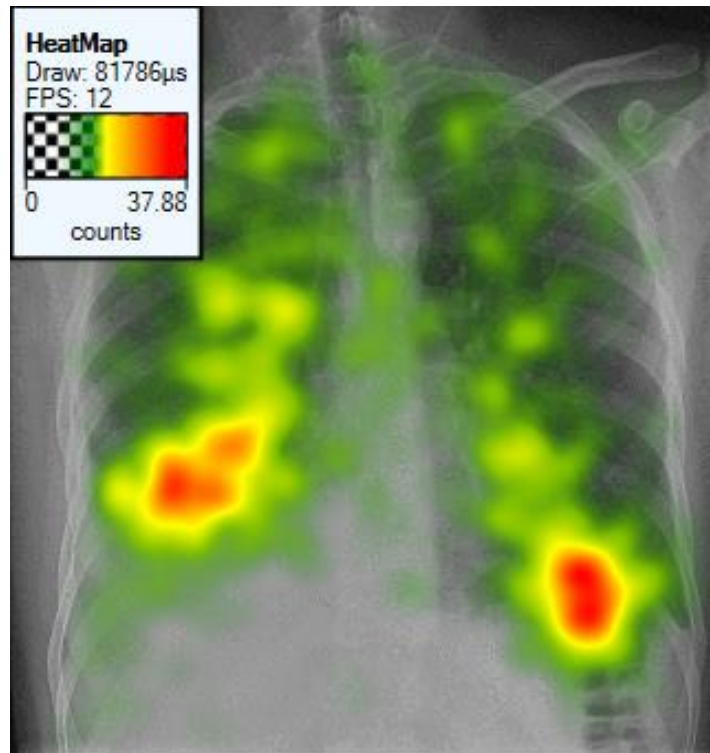


Figure 3.3: Heat map on Pleural Effusion X-ray image (40 participants)

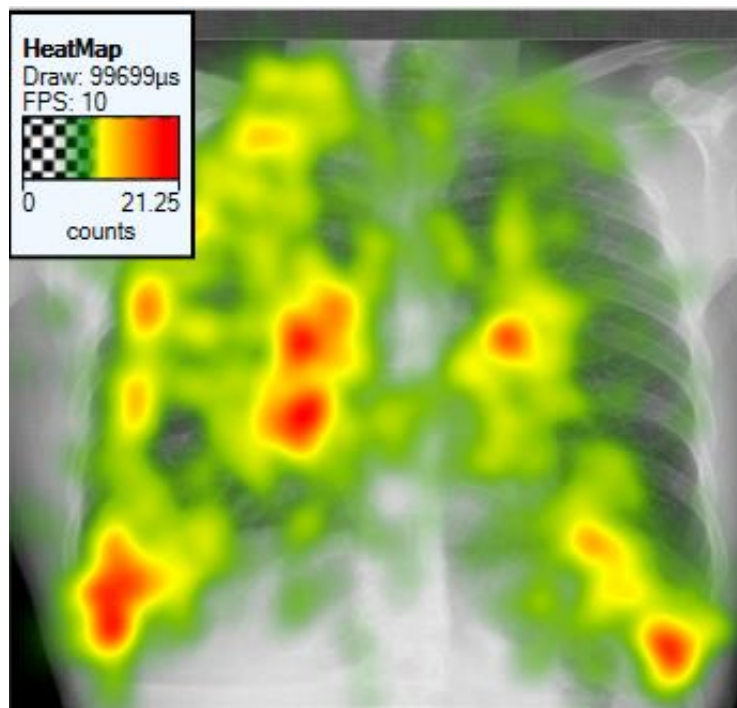


Figure 3.4: Heat map on Pneumothorax X-ray image (40 participants)

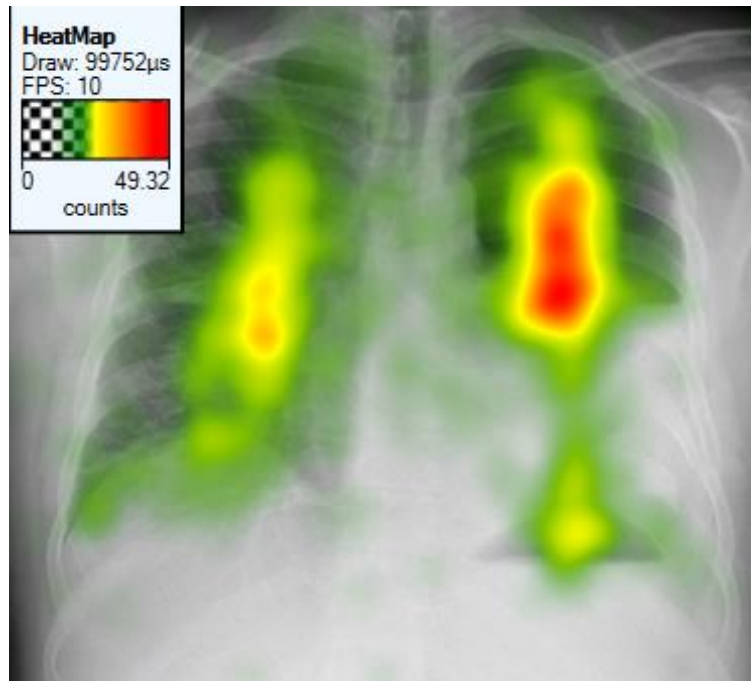


Figure 3.5: Heat map on Pneumo-haemothorax X-ray image (40 participants)

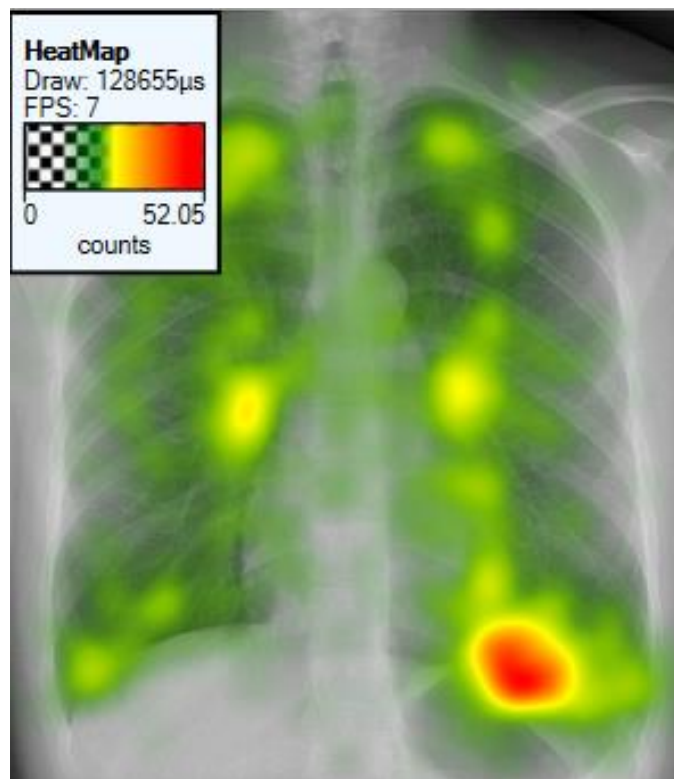


Figure 3.6: Heat map on Normal X-ray image (40 participants)

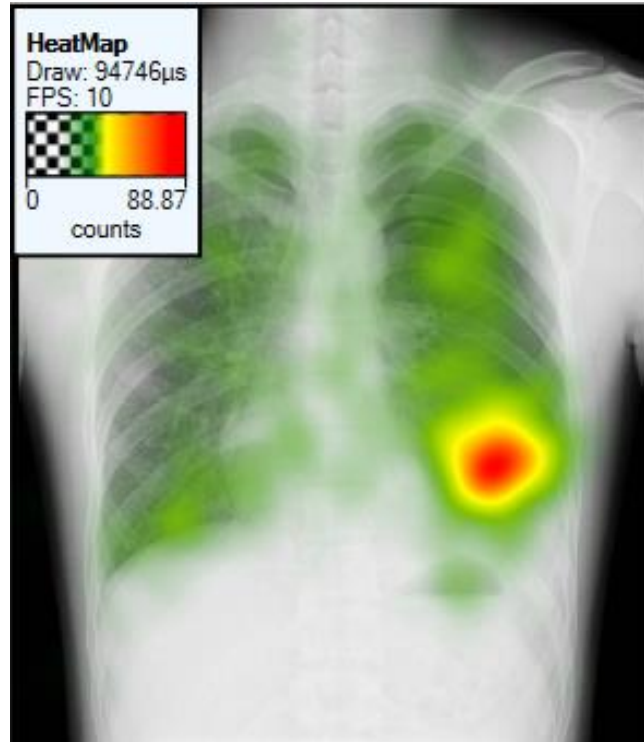


Figure 3.7: Heat map on Pneumo-haemothorax X-ray image (40 participants)

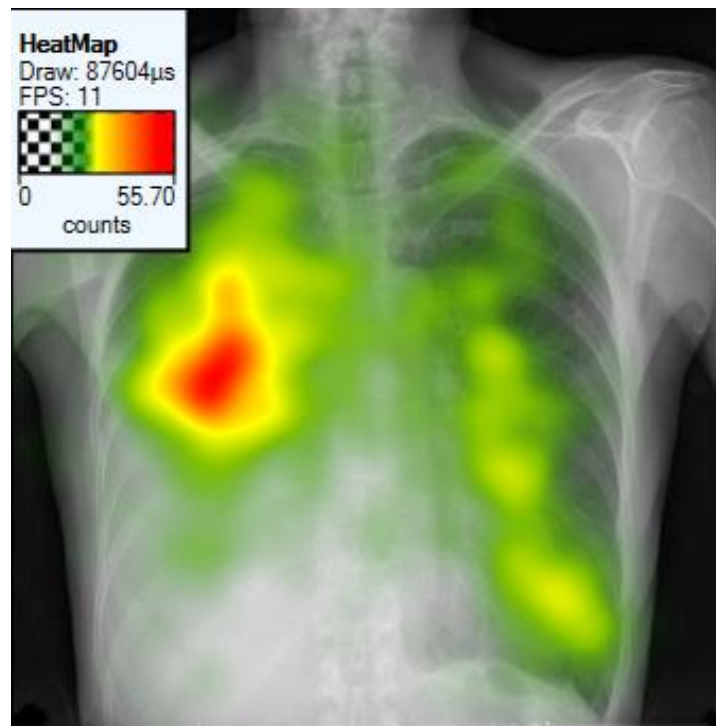


Figure 3.8: Heat map on Pleural Effusion X-ray image (40 participants)

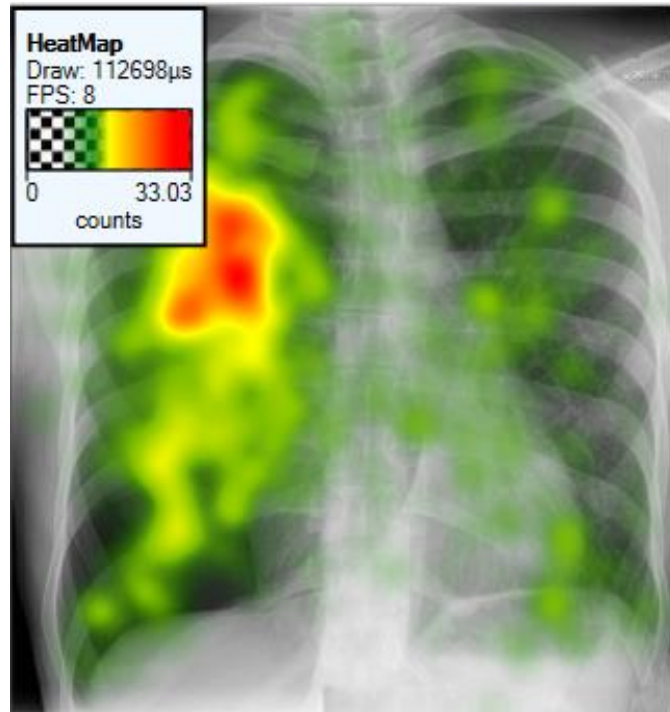


Figure 3.9: Heat map on Pneumothorax X-ray image (40 participants)

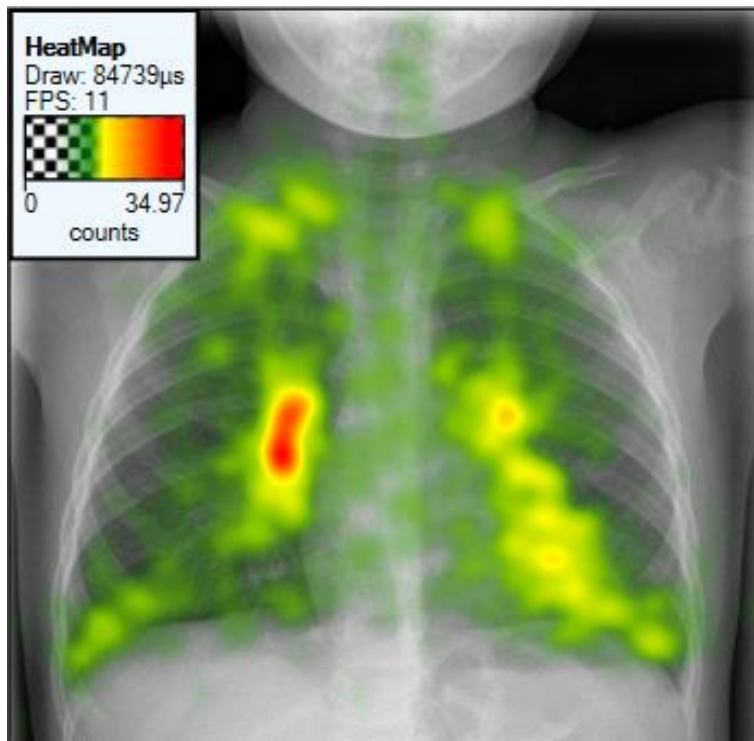


Figure 3.10: Heat map on Pneumonia X-ray image (40 participants)

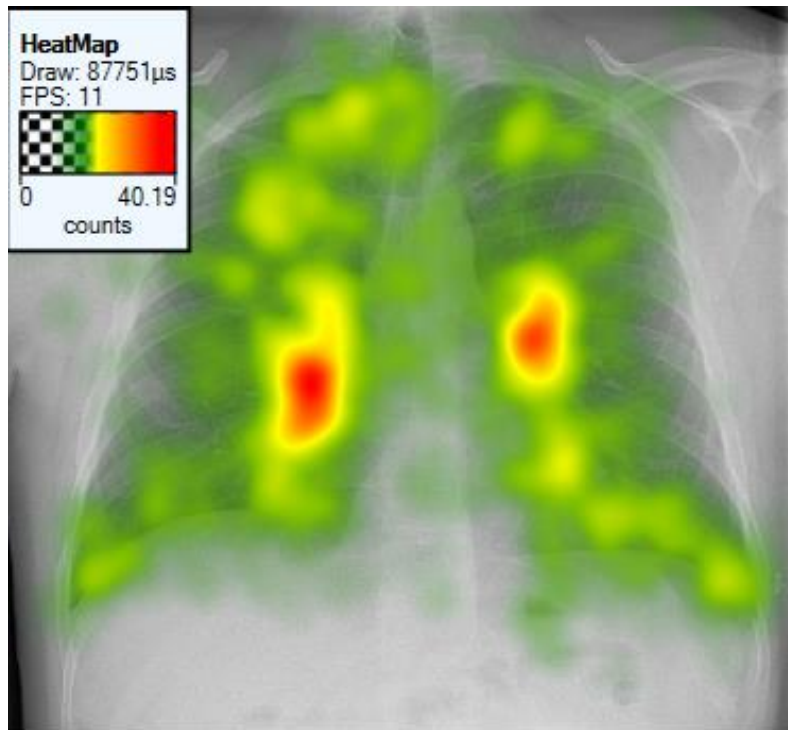


Figure 3.11: Heat map on Normal X-ray image (40 participants)

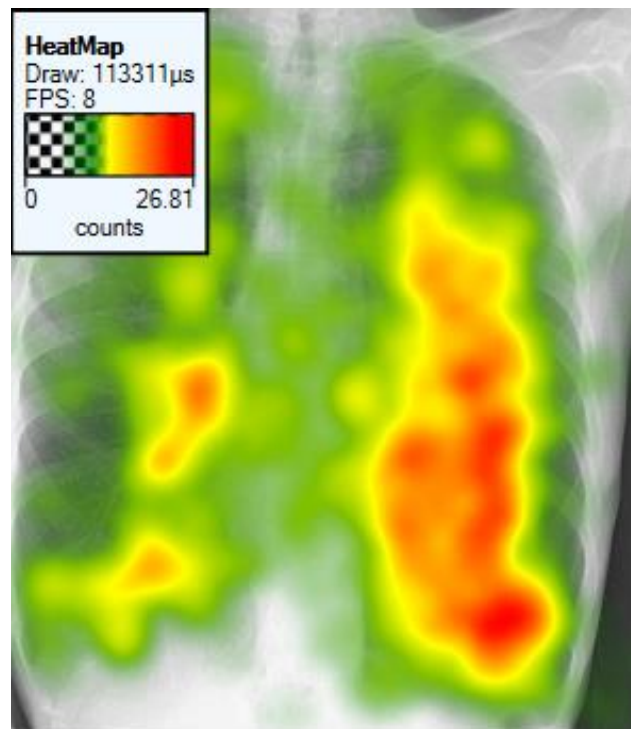


Figure 3.12: Heat map on Pneumothorax X-ray image (40 participants)

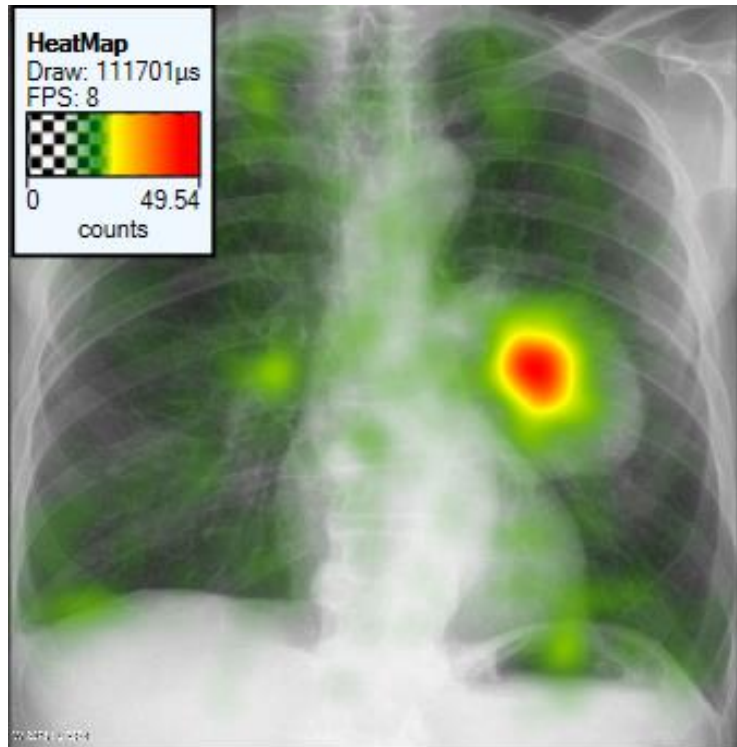


Figure 3.13: Heat map on Lung Cancer X-ray image (40 participants)

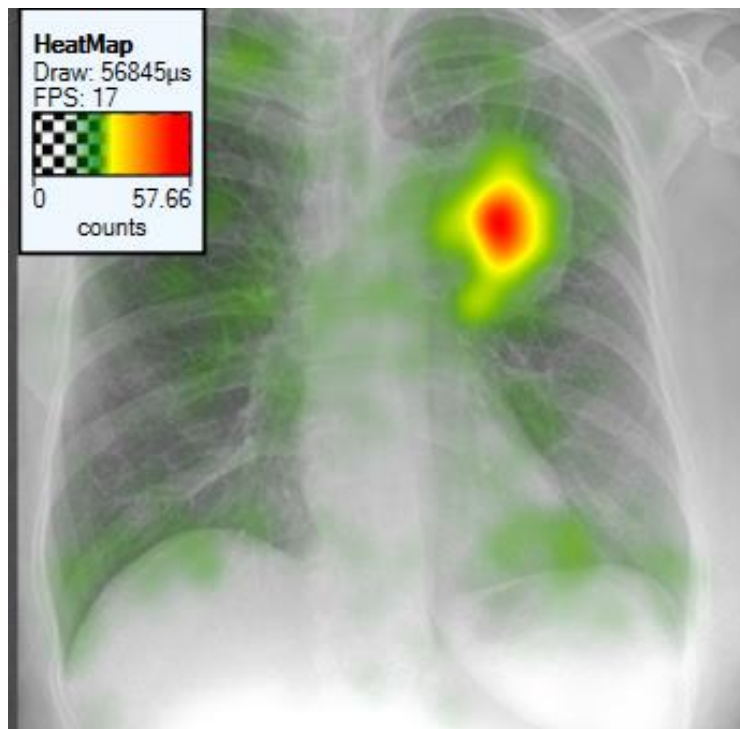


Figure 3.14: Heat map on Lung Cancer X-ray image (40 participants)

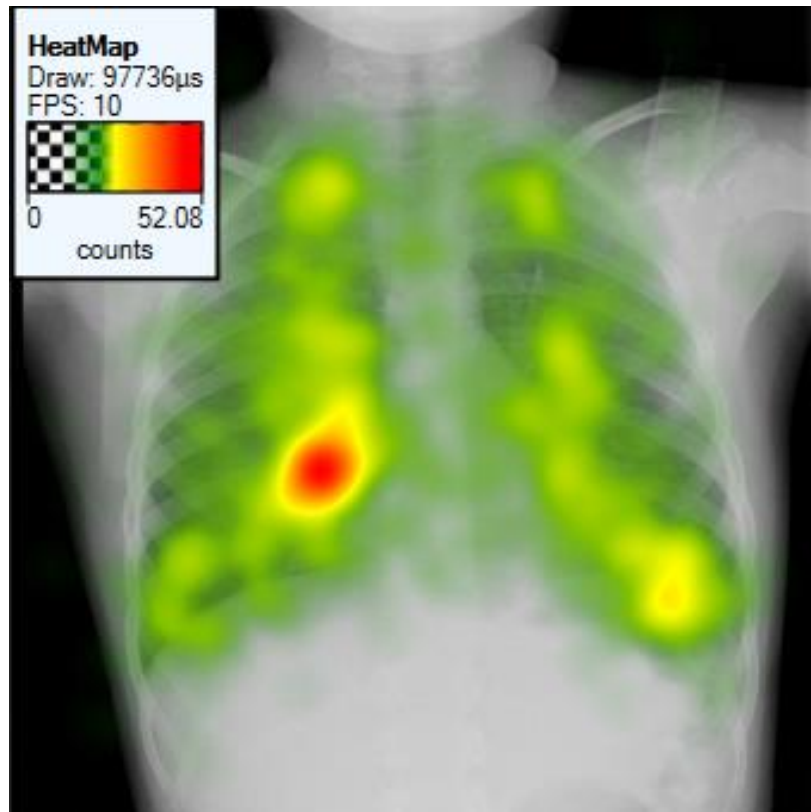


Figure 3.15: Heat map on Pneumonia X-ray image (40 participants)

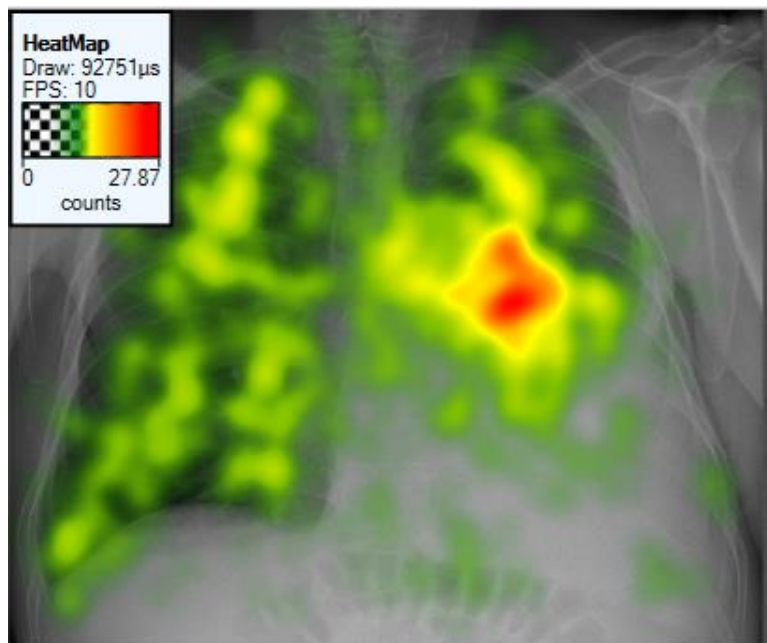


Figure 3.16: Heat map on Pleural Effusion X-ray image (40 participants)

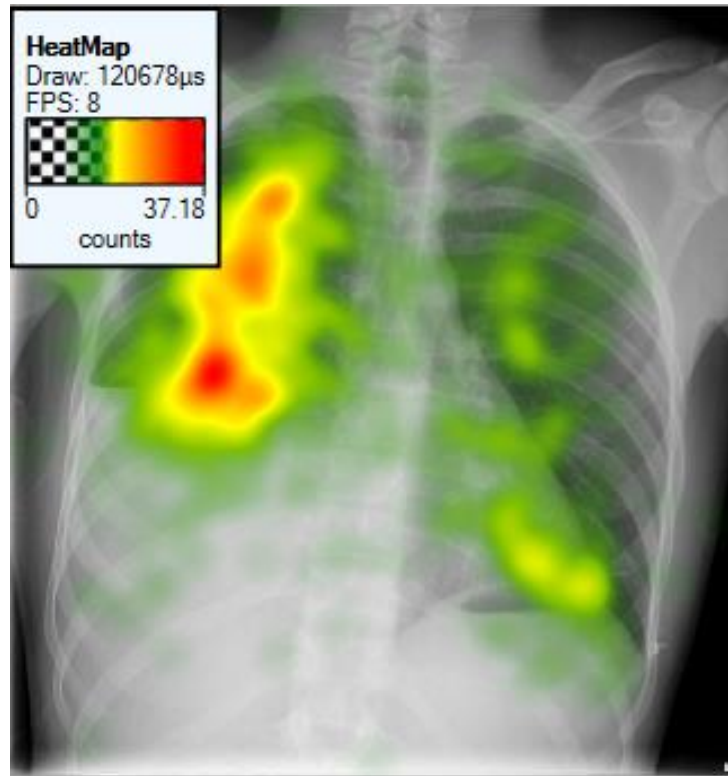


Figure 3.17: Heat map on Pneumo-haemothorax X-ray image (40 participants)

4. Experts' heat maps

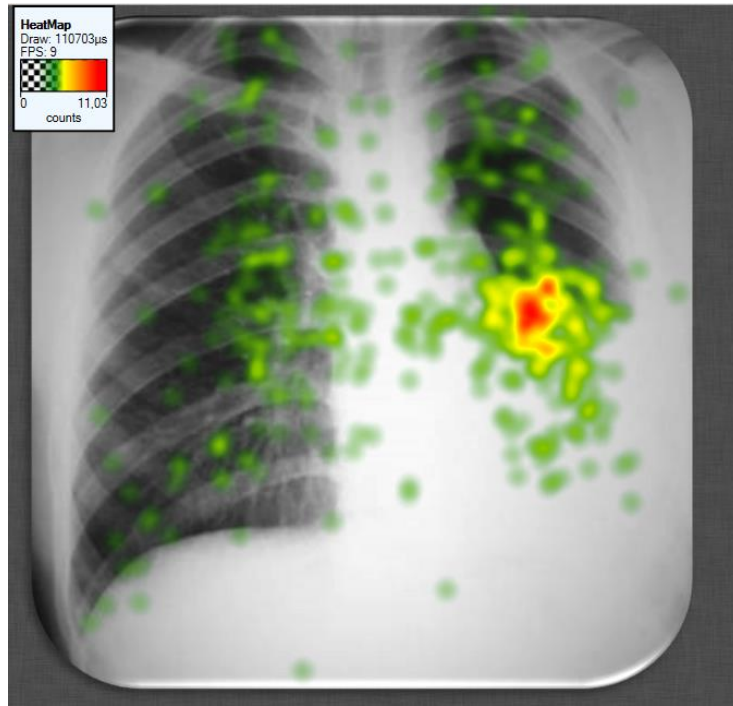


Figure 4.1: Heat map on Pneumo-haemothorax X-ray image (23 participants)

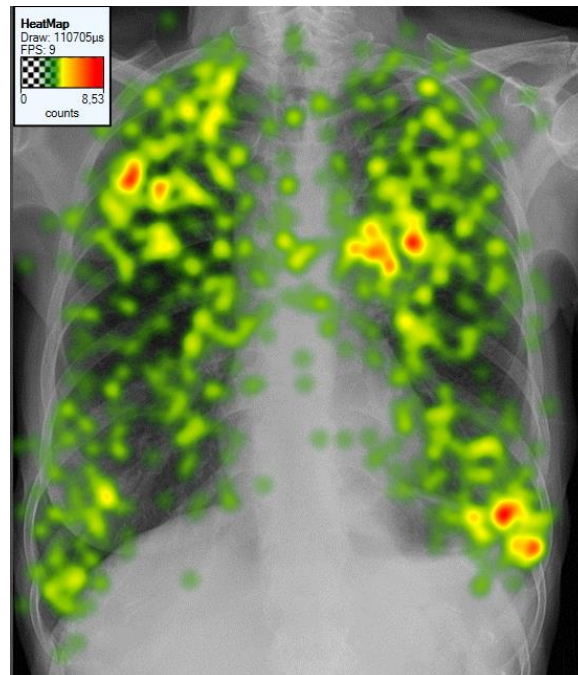


Figure 4.2: Heat map on Lung Cancer X-ray image (23 participants)

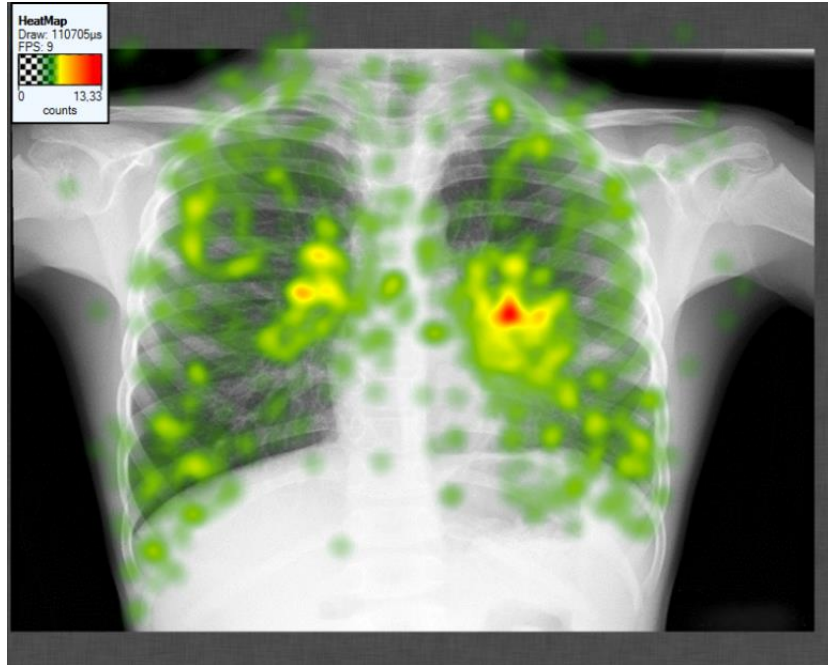


Figure 4.3: Heat map on Pneumonia X-ray image (23 participants)

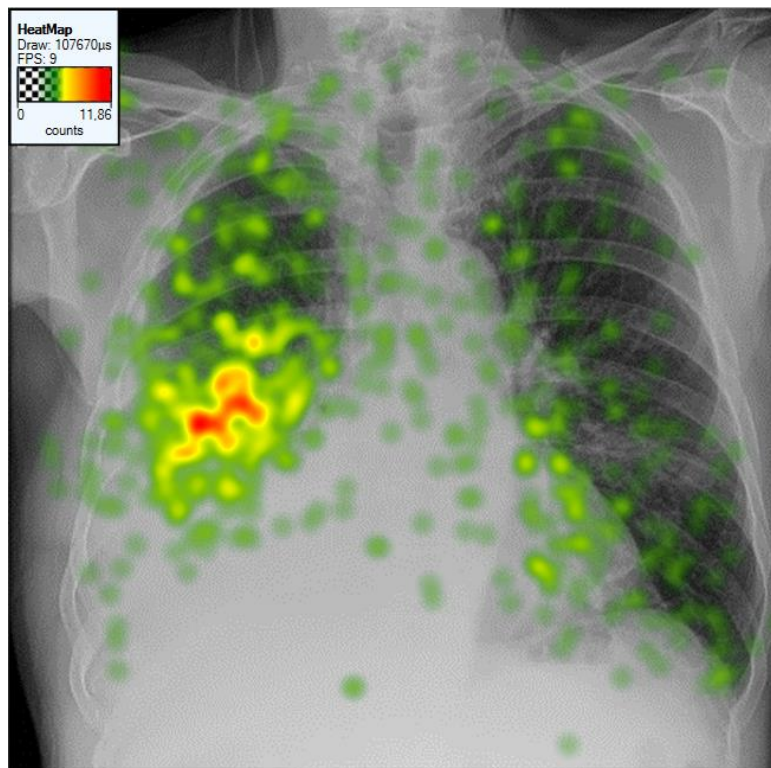


Figure 4.4: Heat map on Pleural Effusion X-ray image (23 participants)

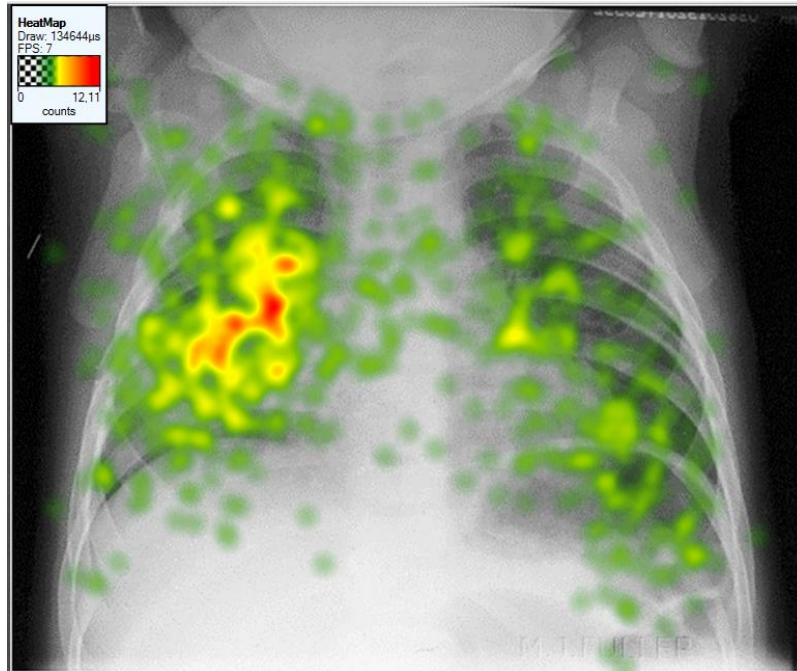


Figure 4.5: Heat map on Pneumonia X-ray image (23 participants)

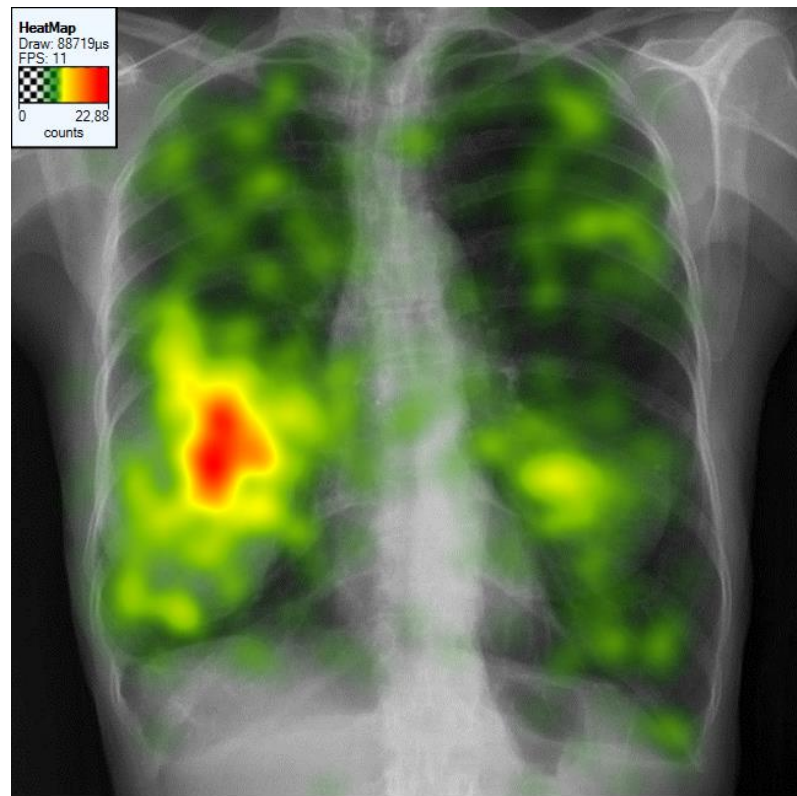


Figure 4.6: Heat map on Lung Cancer X-ray image (23 participants)

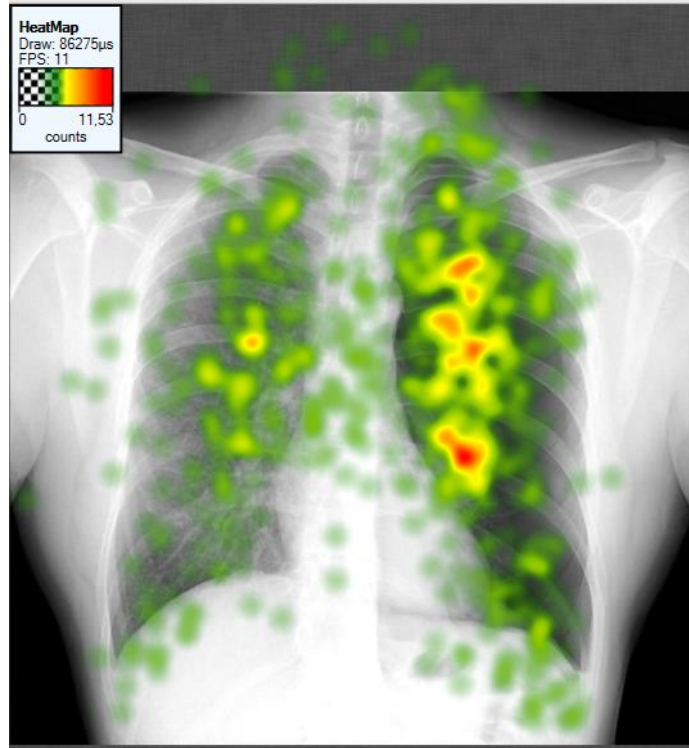


Figure 4.7: Heat map on Pneumothorax X-ray image (23 participants)

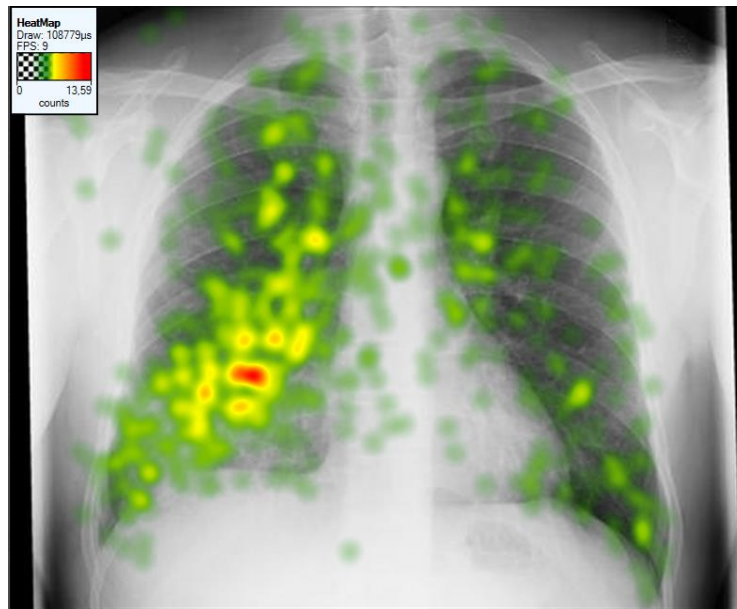


Figure 4.8: Heat map on Pneumonia X-ray image (23 participants)

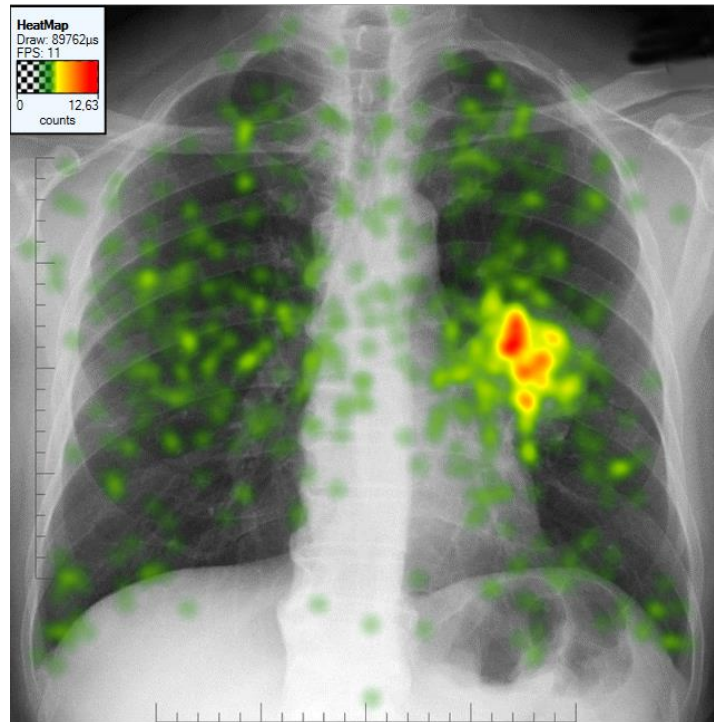


Figure 4.9: Heat map on Lung Cancer X-ray image (23 participants)

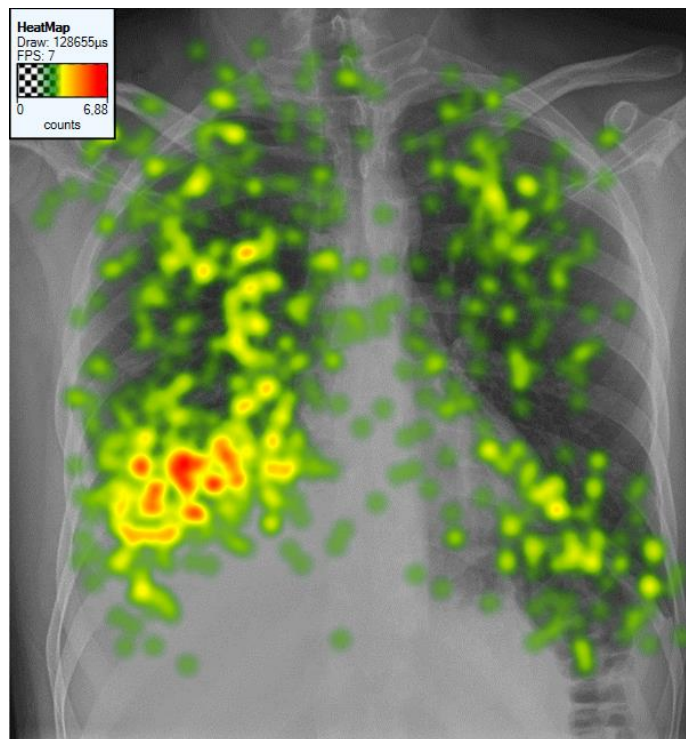


Figure 4.10: Heat map on Pleural Effusion X-ray image (23 participants)

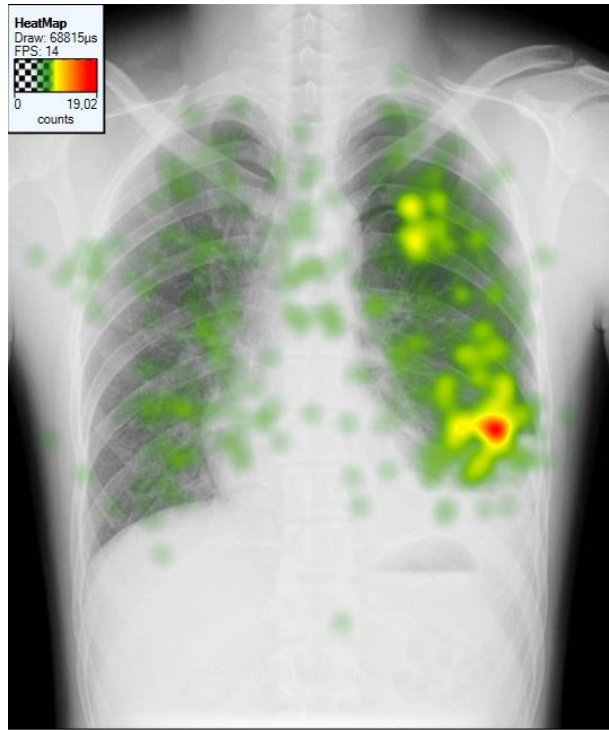


Figure 4.11: Heat map on Pneumo-haemothorax X-ray image (23 participants)

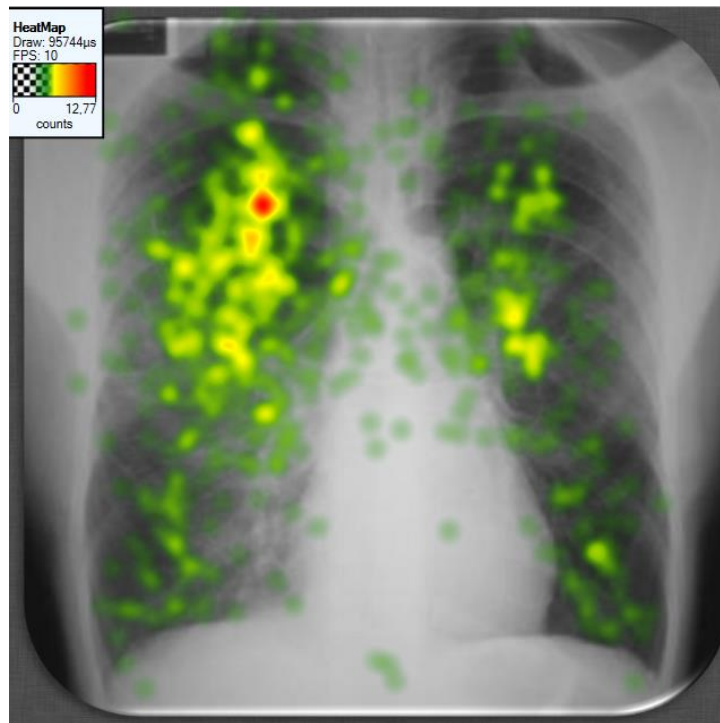


Figure 4.12: Heat map on Pneumothorax X-ray image (23 participants)

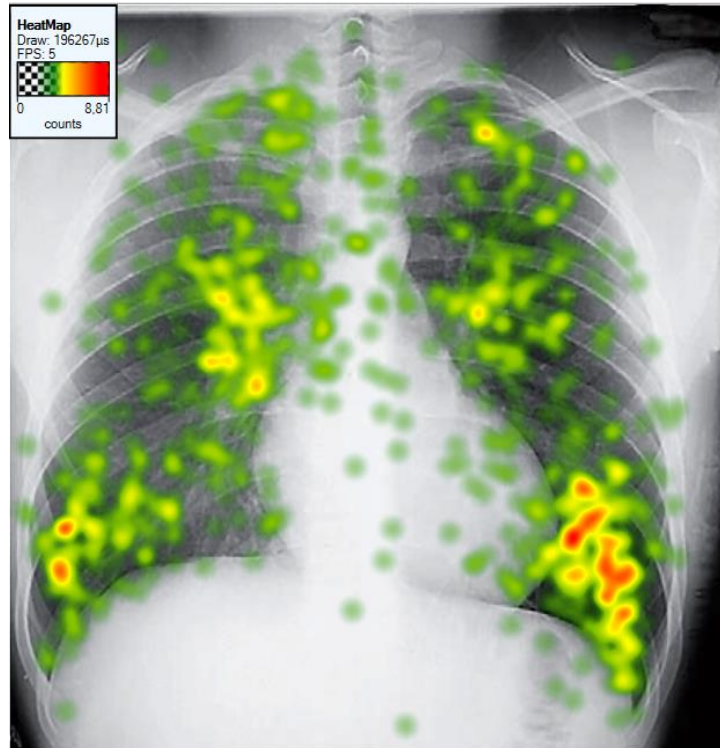


Figure 4.13: Heat map on Normal X-ray image (23 participants)

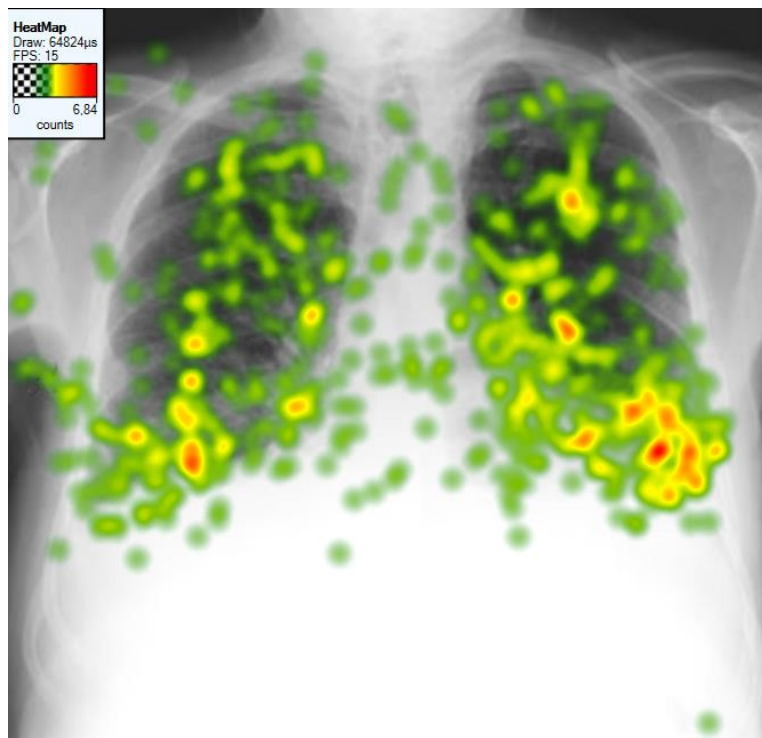


Figure 4.14: Heat map on Pleural Effusion X-ray image (23 participants)

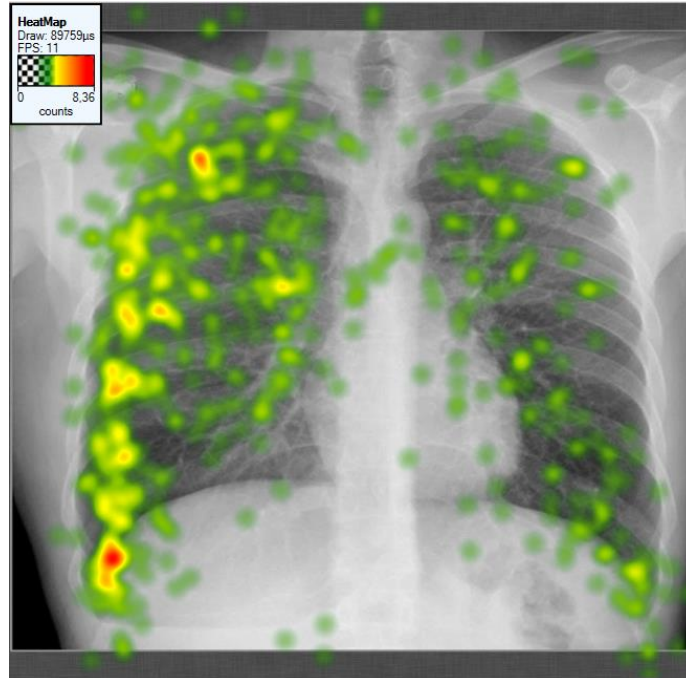


Figure 4.15: Heat map on Pneumothorax X-ray image (23 participants)

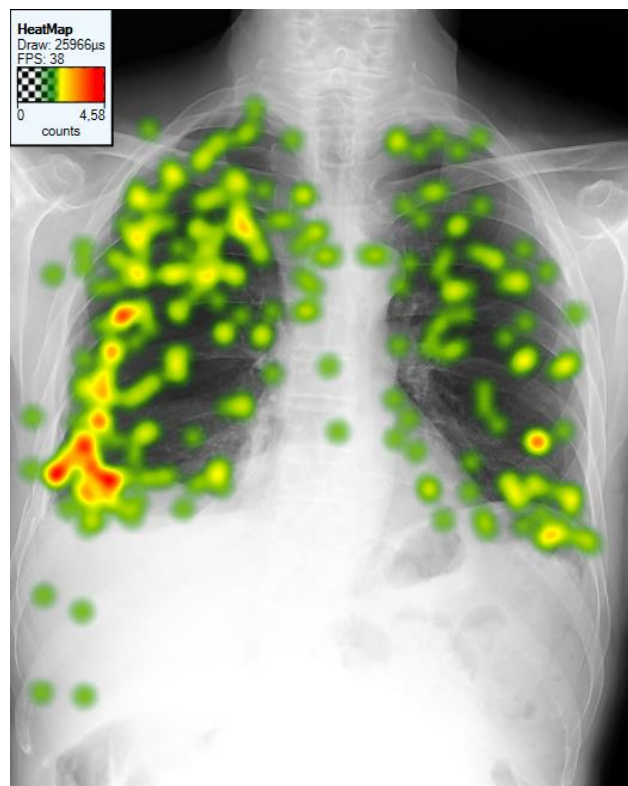


Figure 4.16: Heat map on Pneumo-haemothorax X-ray image (23 participants)

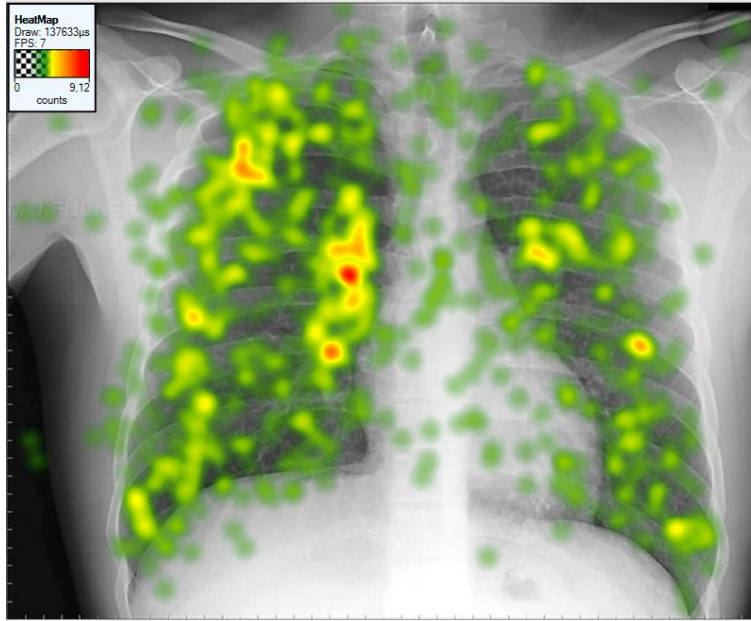


Figure 4.17: Heat map on Normal X-ray image (23 participants)

Appendix F: Gaze plots

1. Introduction

This appendix presents the gaze plots that were gathered as experts analysed the chest X-ray images. Gaze plots were generated from the best experts' gaze behaviours and they were used to show the position, the sequence and the amount of time spent looking at various parts of the stimulus. These gaze plots were generated from various experts' gaze behaviours and are not based on a specific individual. The best experts' gaze plots criteria are referenced in Section 3.3.6. Gaze plots include lines and dots. Dots demonstrate fixations and the lines link those fixations to show the sequence and the gaze movement's direction. Gaze plots are referenced in Section 3.3.6.

This appendix specifically recorded the experts' gaze plots that were used for training novices. Although Tobii Studio presents the gaze plots in a form of videos, this appendix only presents them as captured images.

2. Experts' gaze plots

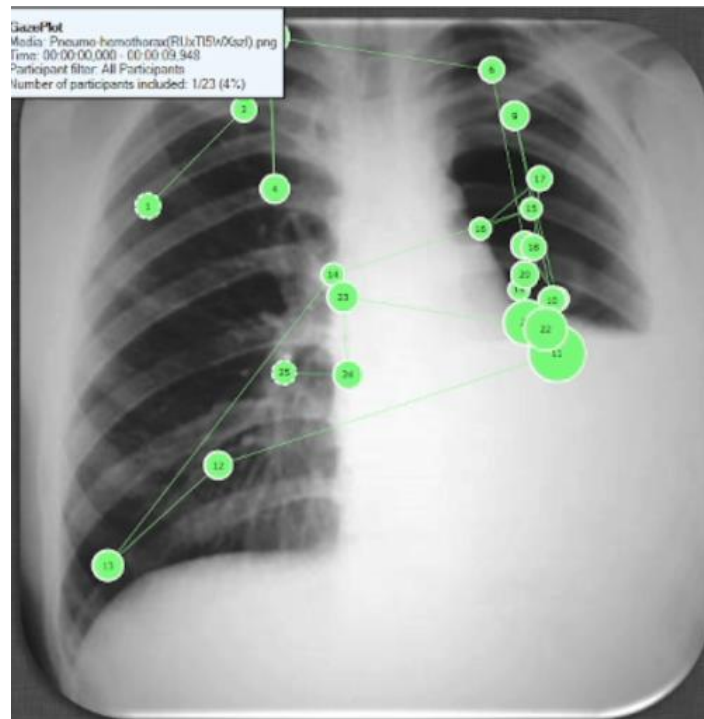


Figure 2.1: Pnemo-haemothorax gaze plot

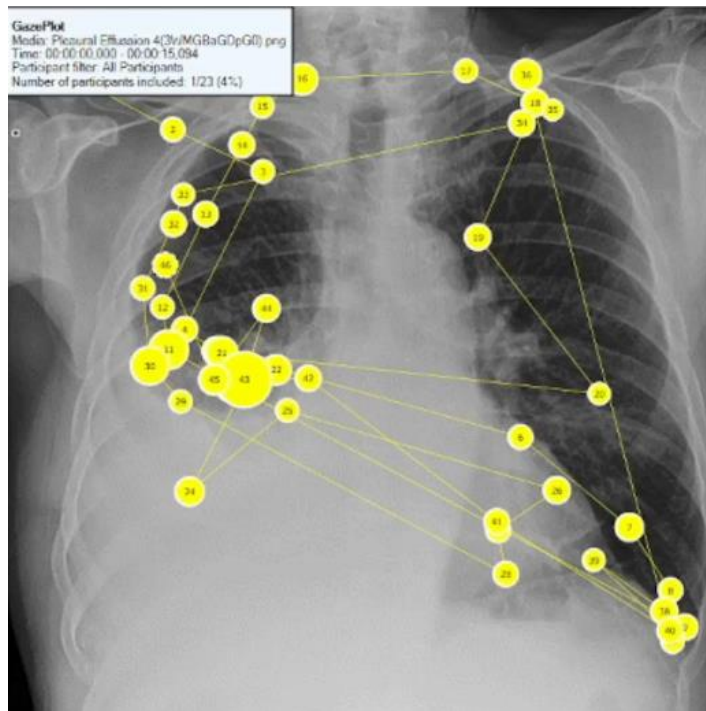


Figure 2.2: Pleural effusion gaze plot

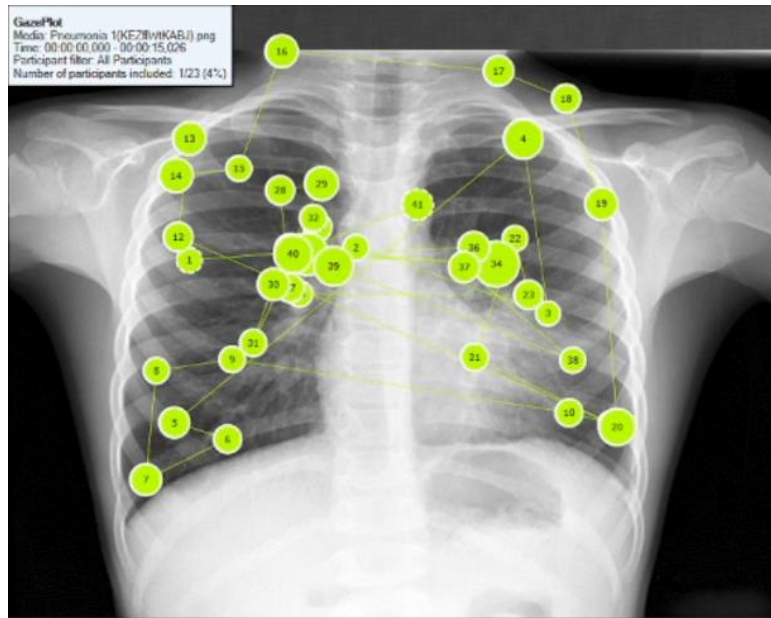


Figure 2.3: Pneumonia gaze plot

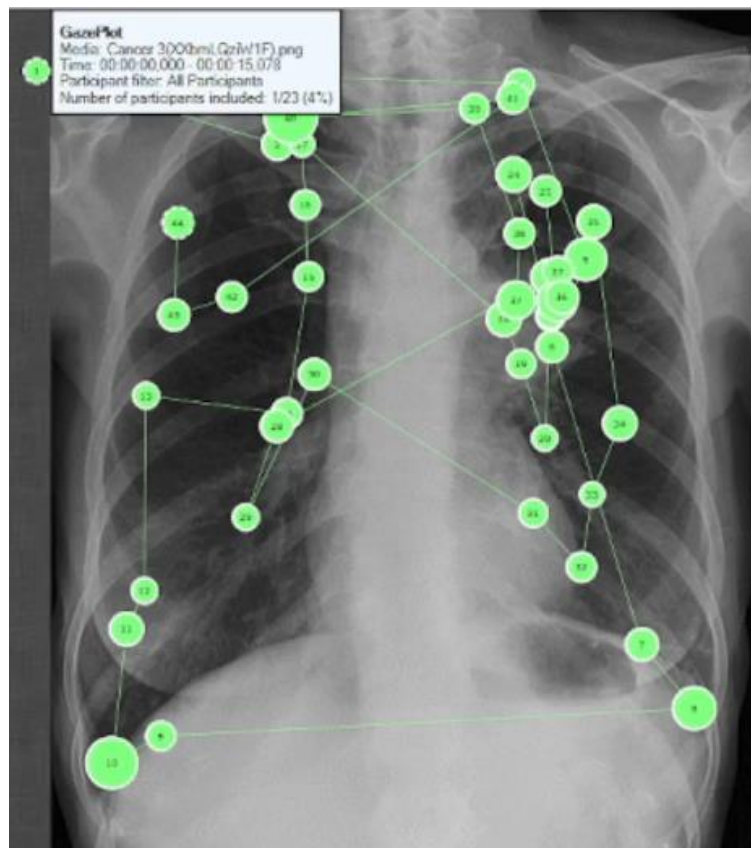


Figure 2.4: Lung cancer gaze plot

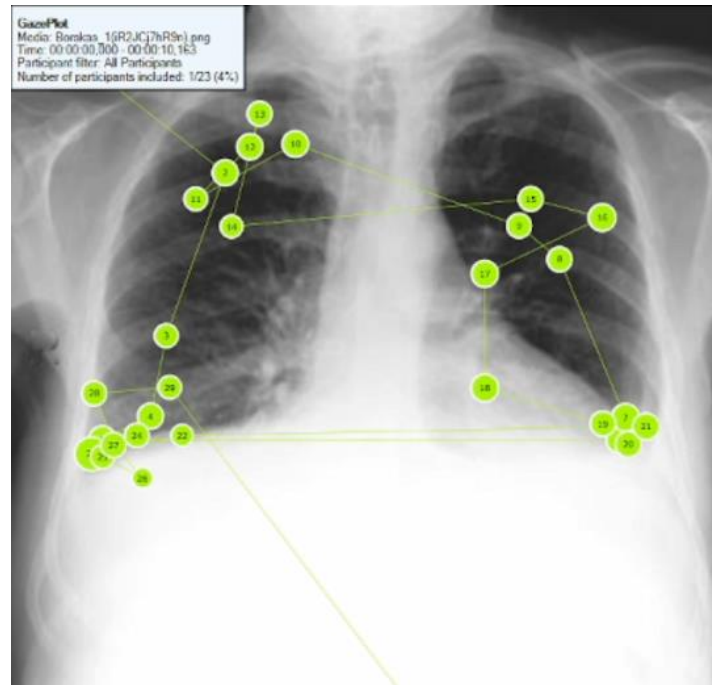


Figure 2.5: Pleural effusion gaze plot

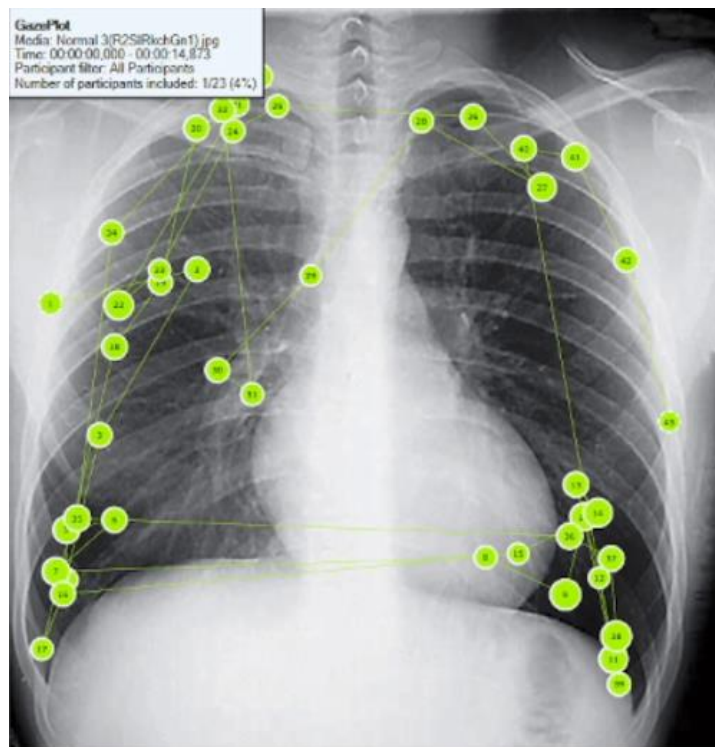


Figure 2.6: Normal X-ray gaze plot

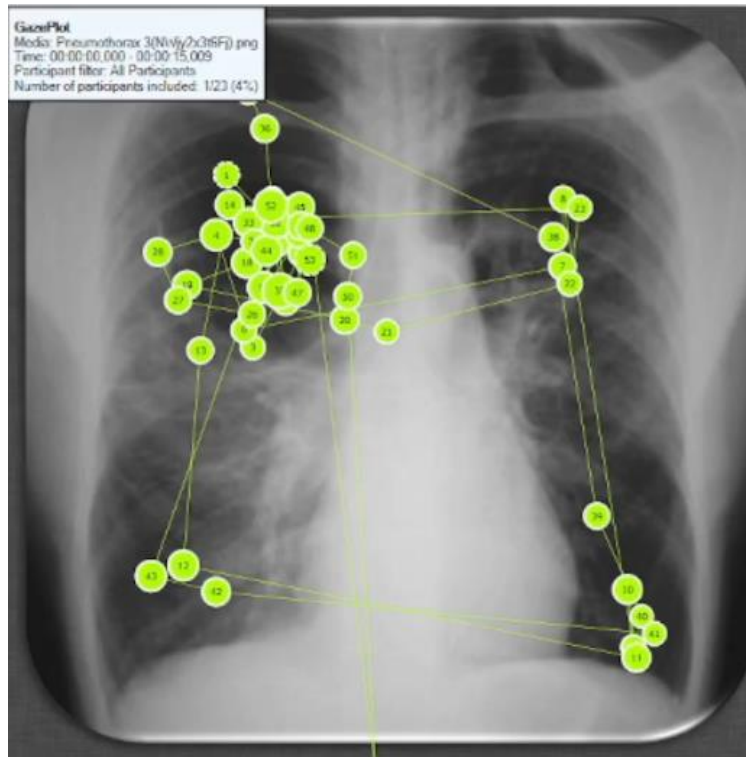


Figure 2.7: Pneumothorax gaze plot

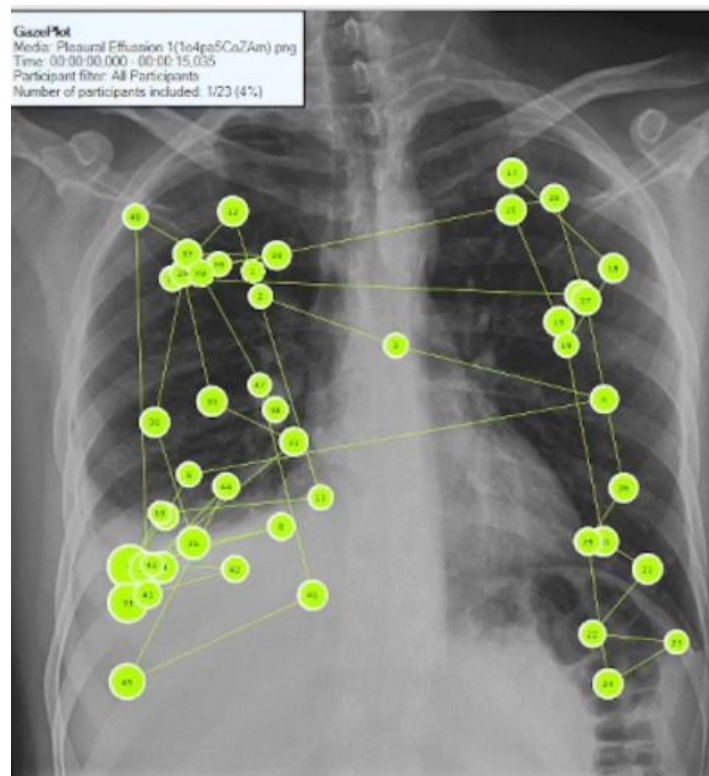


Figure 2.8: Pleural effusion gaze plot

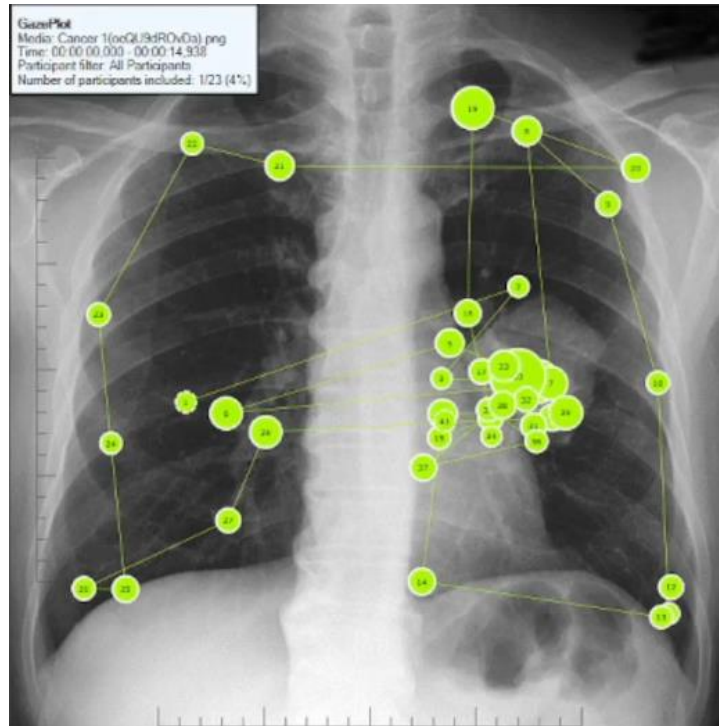


Figure 2.9: Lung cancer gaze plot

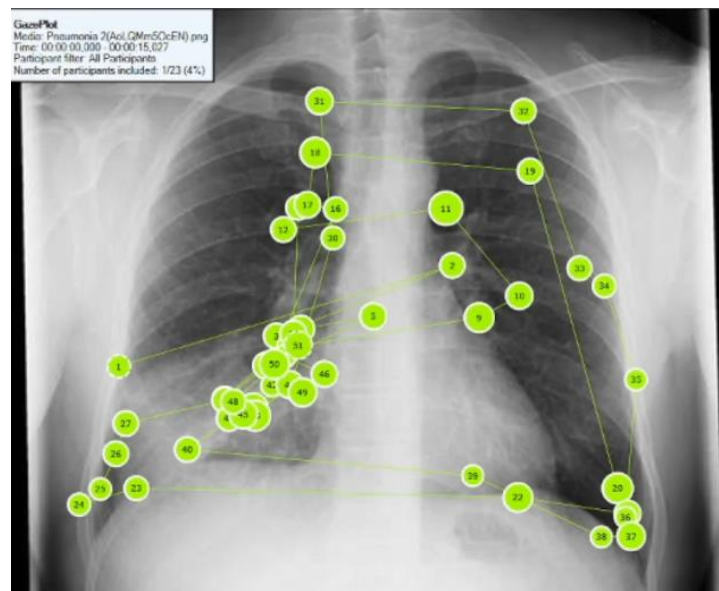


Figure 2.10: Pneumonia gaze plot

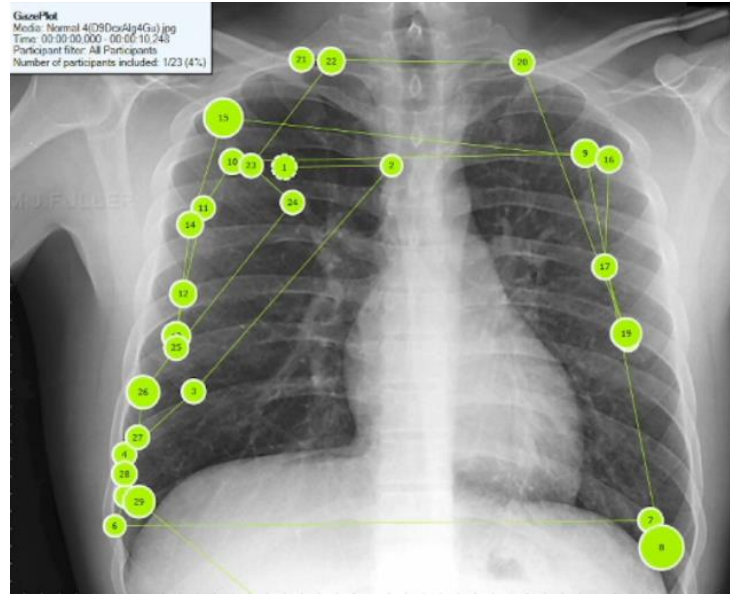


Figure 2.11: Normal X-ray gaze plot

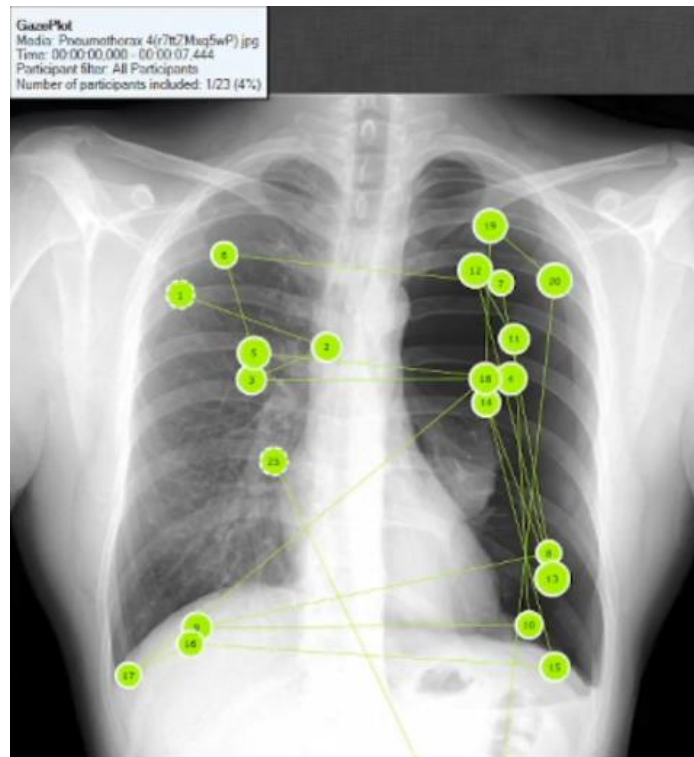


Figure 2.12: Pneumo-haemothorax gaze plot

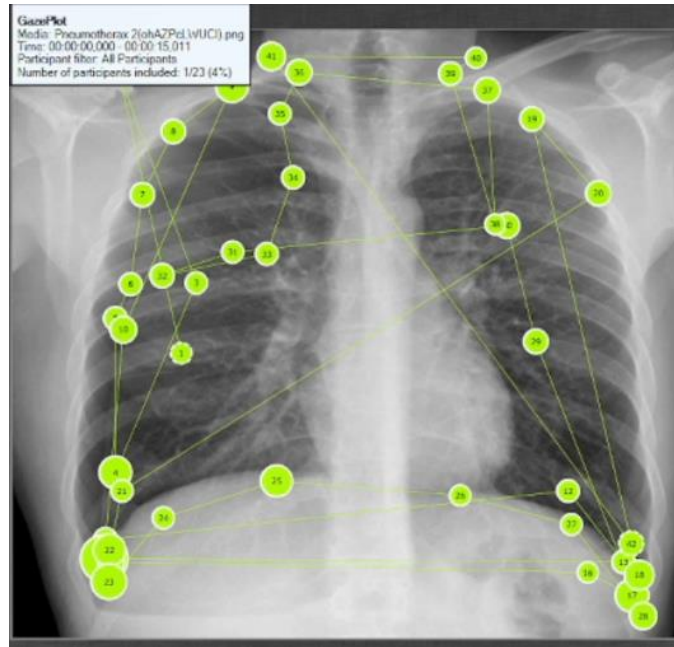


Figure 2.13: Pneumothorax gaze plot

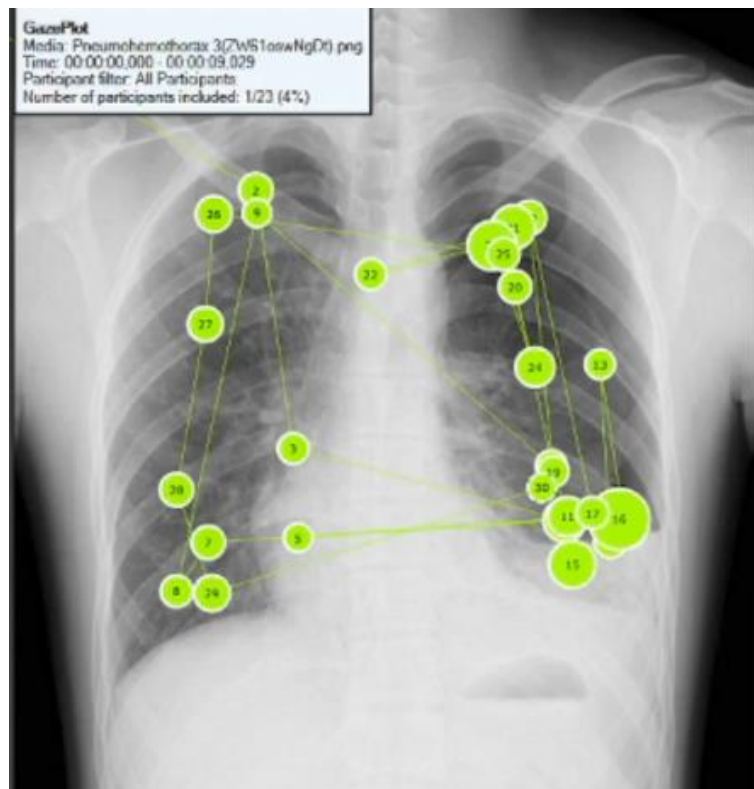


Figure 2.14: Pneumo-haemothorax gaze plot

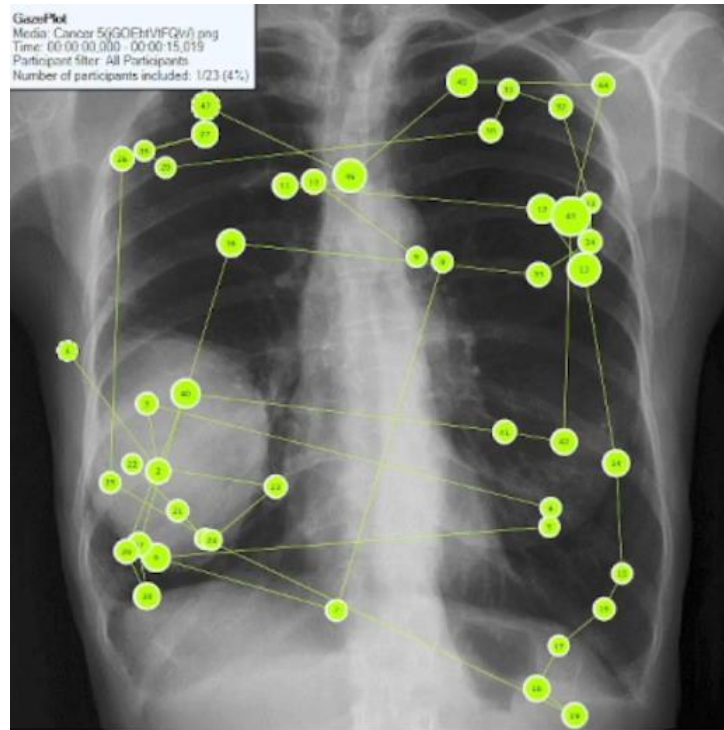


Figure 2.15: Lung cancer gaze plot

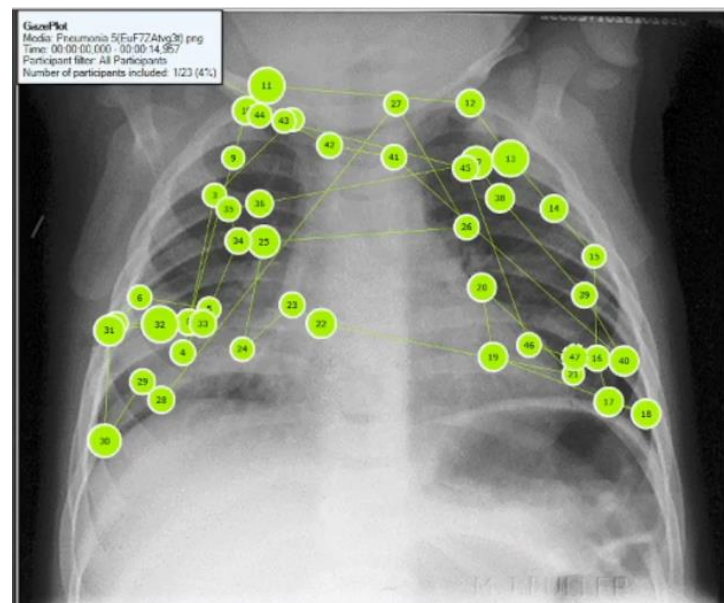


Figure 2.16: Pneumonia gaze plot

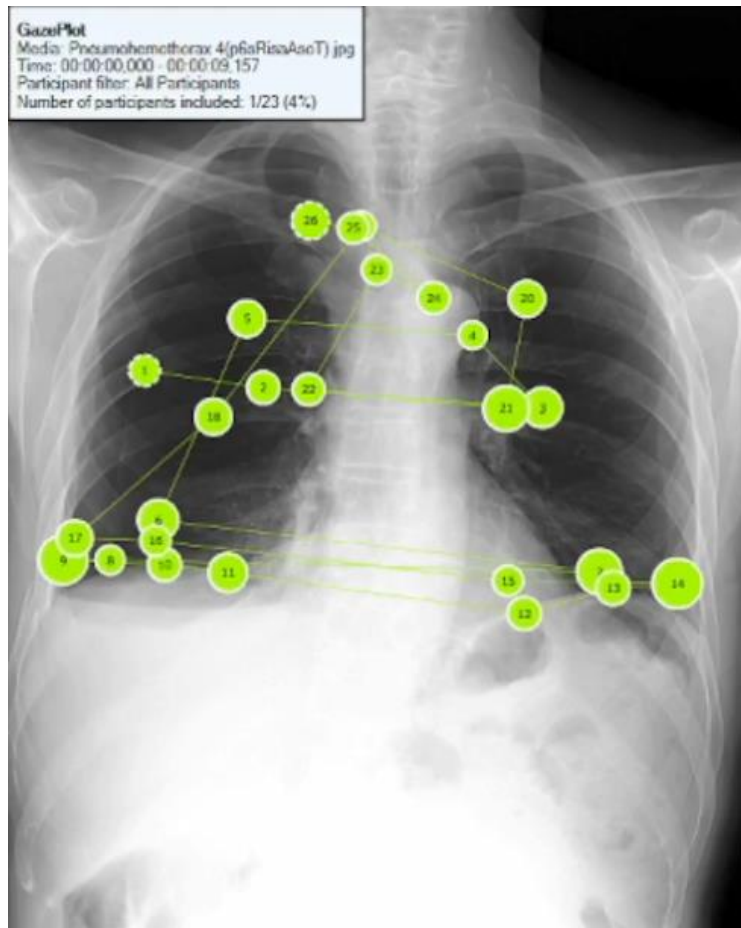


Figure 2.17: Pneumo-haemothorax gaze plot

Appendix G: Training Slides

1. Introduction

After the novices were tested using the eye-tracking equipment, they were trained using the experts' gaze behaviours and eye movements when analysing the chest X-ray images. This appendix presents the slides that were used to train the novices. Only the best experts' eye movements and gaze behaviours were used to train the novices. The gaze plot videos were used as part of the training along with the heat maps referenced in Appendix E. This appendix is referenced in Section 3.3.6.

2. Normal lung

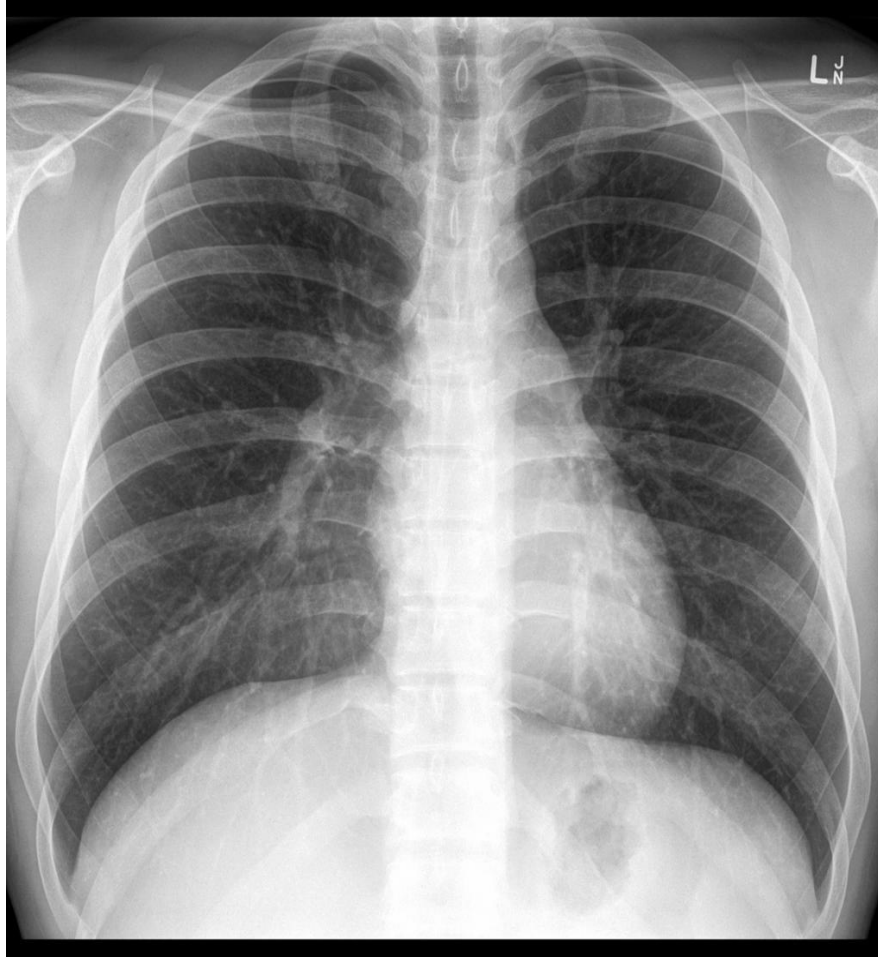


Figure 2.1: Normal X-ray image

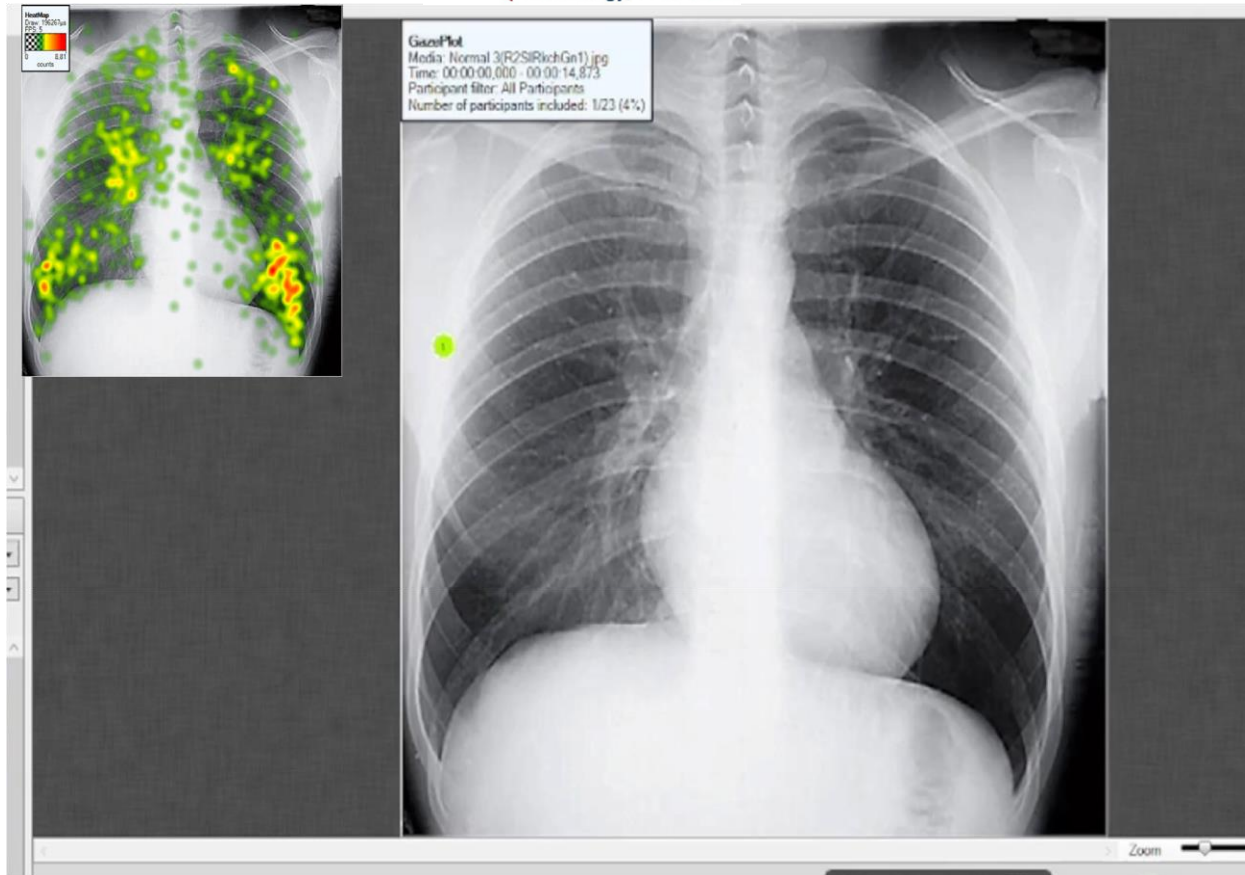


Figure 2.2: Heat maps and gaze plots on normal X-ray image

3. Pleural effusion both



Figure 3.1: Pleural effusion X-ray image

4. Pleural effusion L

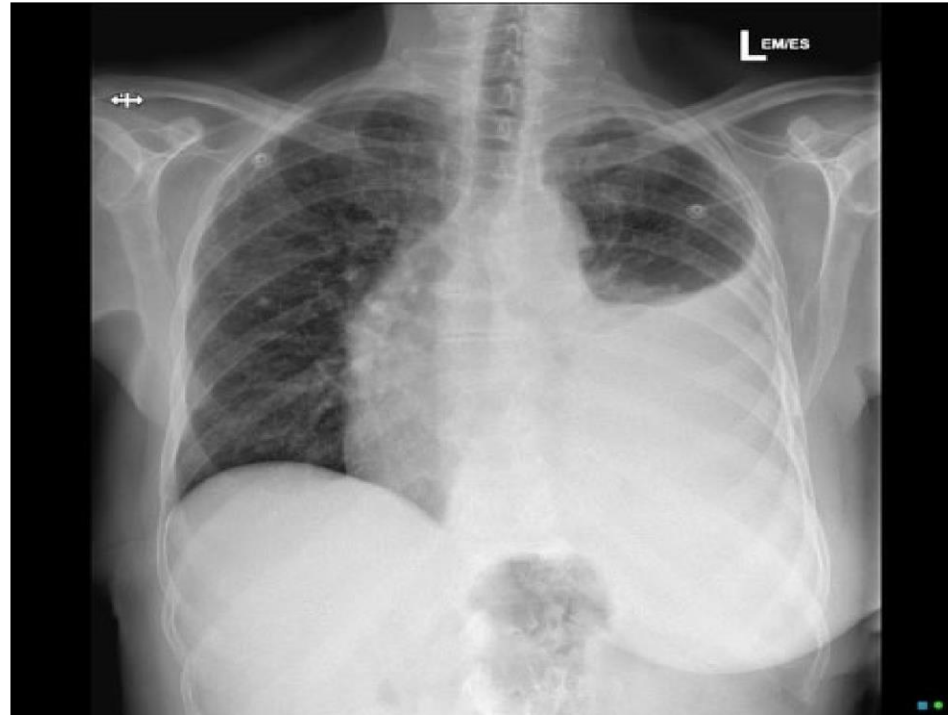


Figure 4.1: Pleural effusion X-ray image

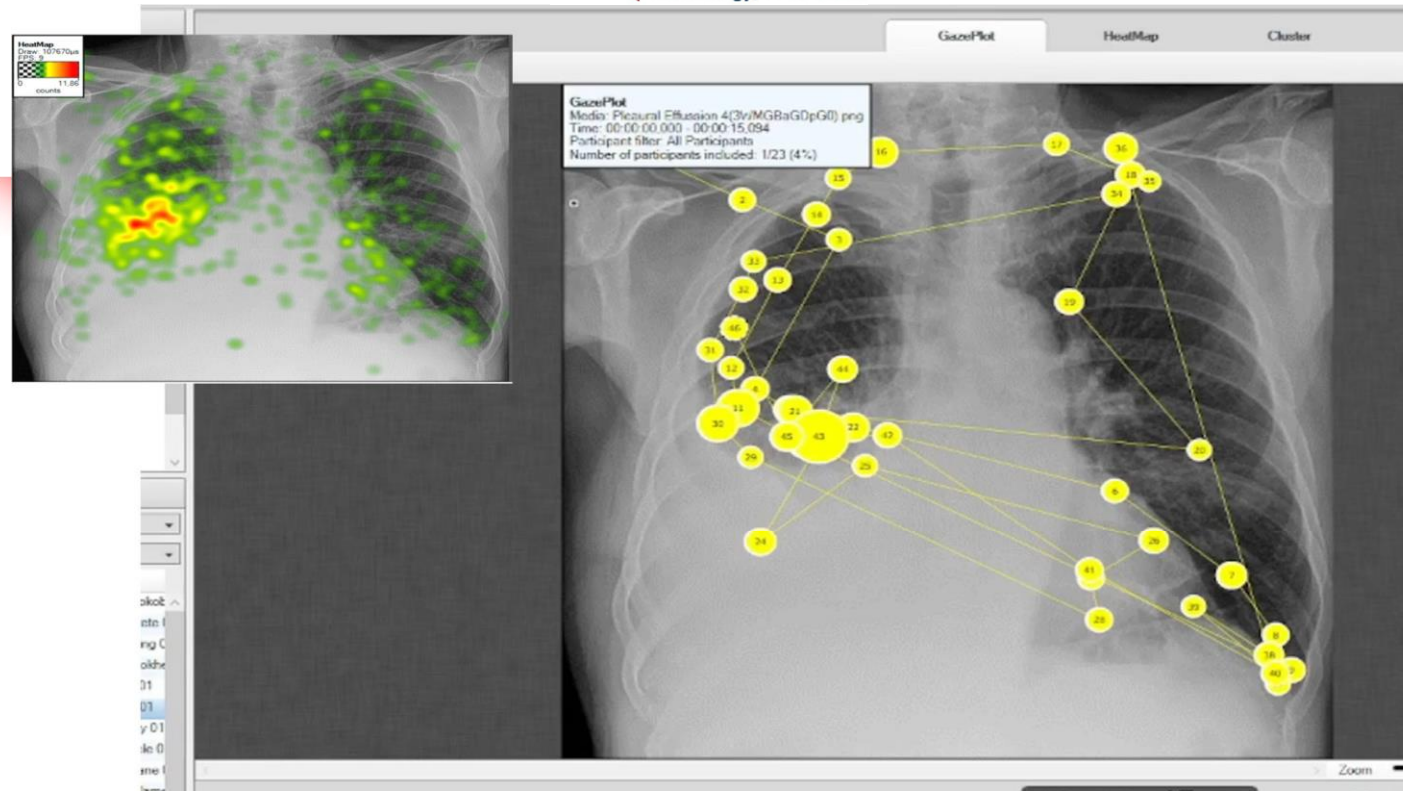


Figure 4.2: Heat maps and gaze plots on pleural effusion X-ray image

5. Pneumonia R



Figure 5.1: Pneumonia X-ray image

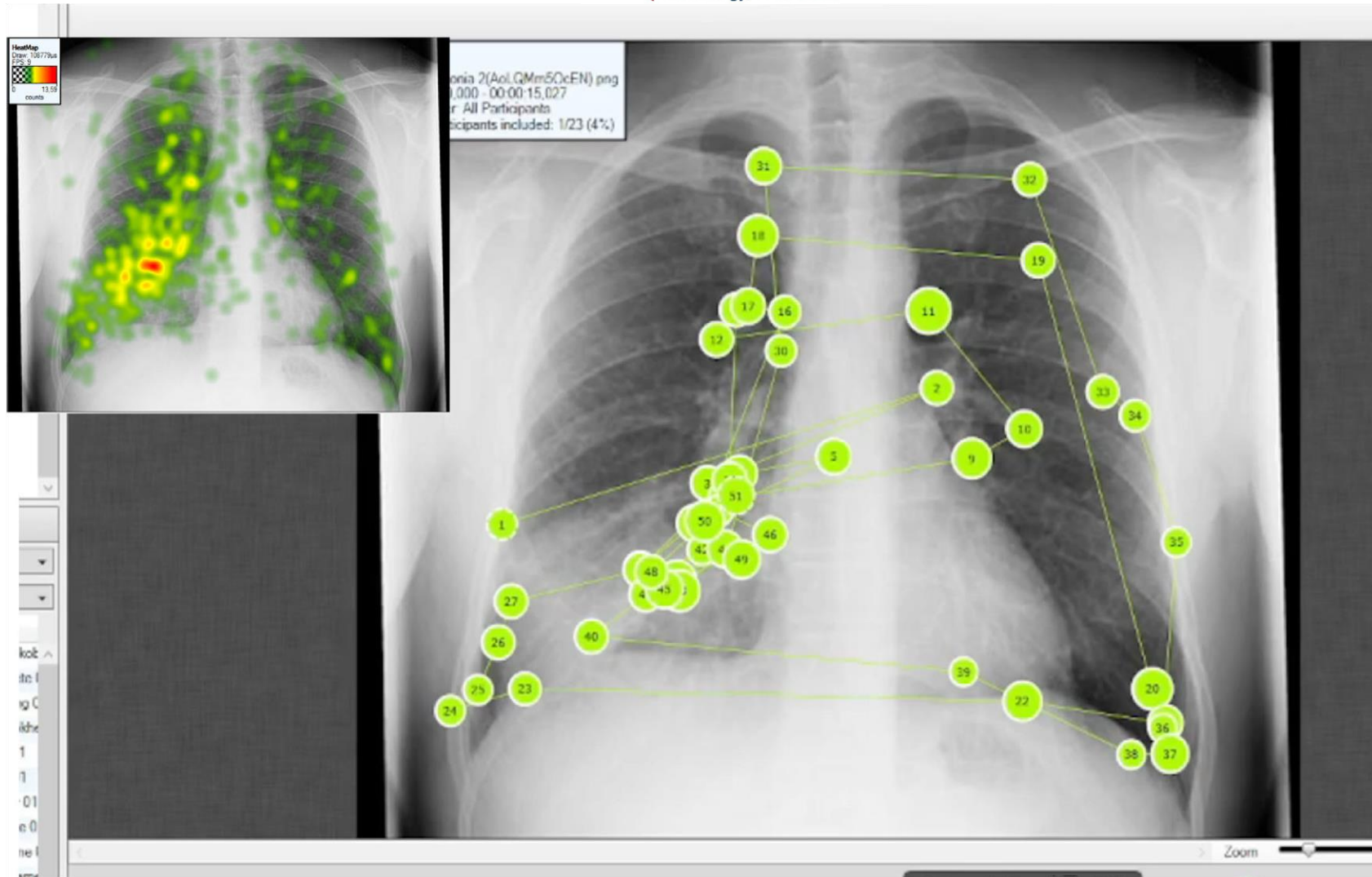


Figure 5.2: Heat maps and gaze plots on pneumonia X-ray image

6. Lung cancer

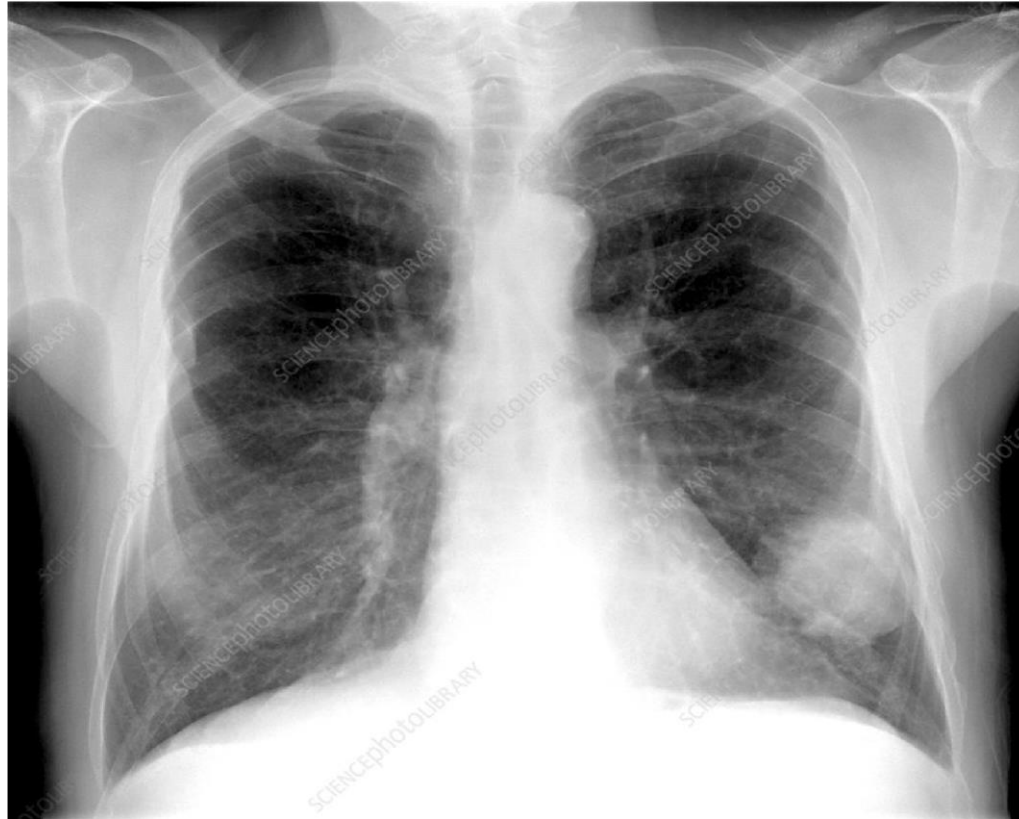


Figure 6.1: Lung cancer X-ray image

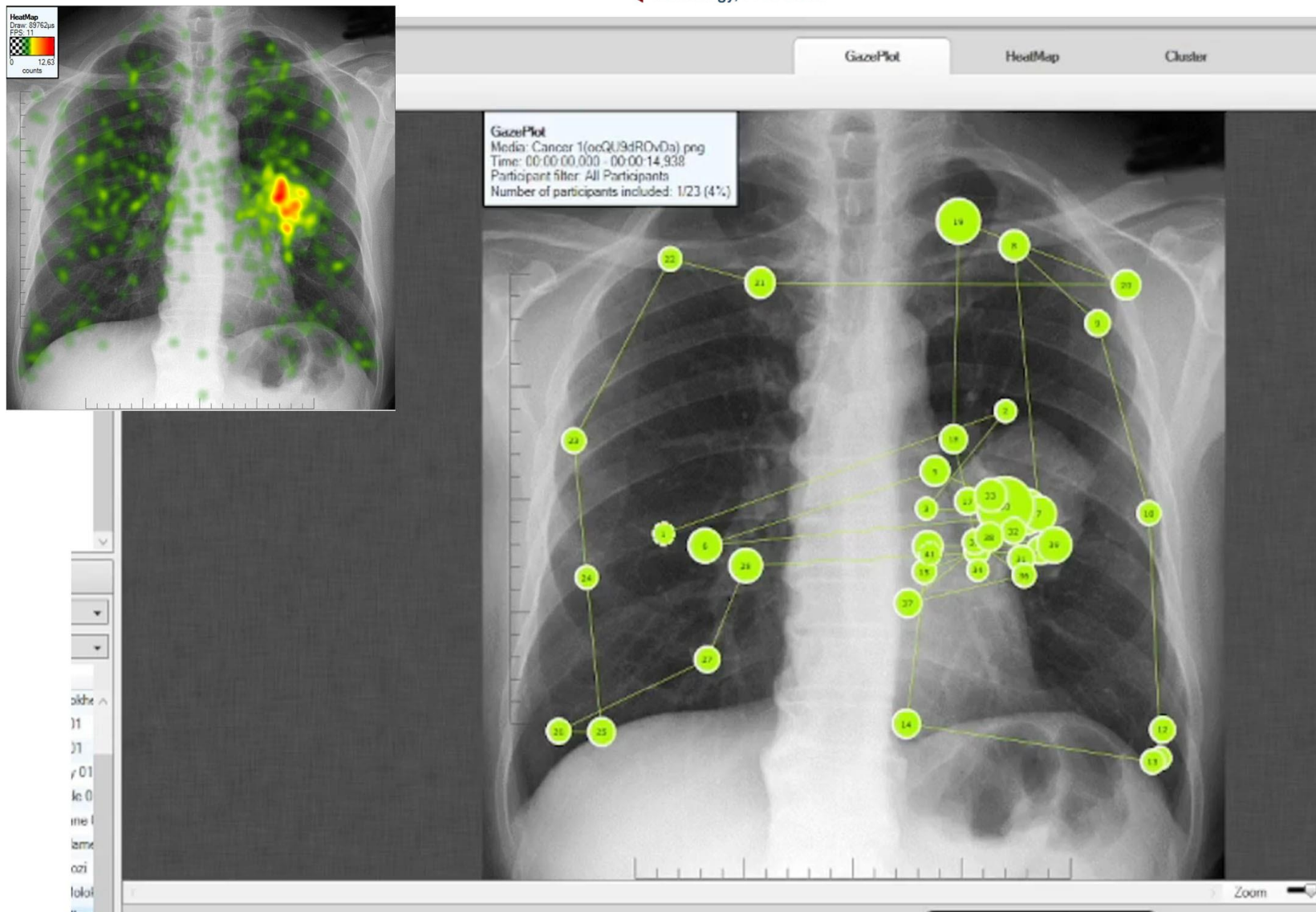


Figure 6.2: Heat maps and gaze plots on lung cancer X-ray image



Figure 6.3: Lung cancer (metastases) X-ray image

7. Pneumothorax



Figure 7.1: Pneumothorax X-ray image

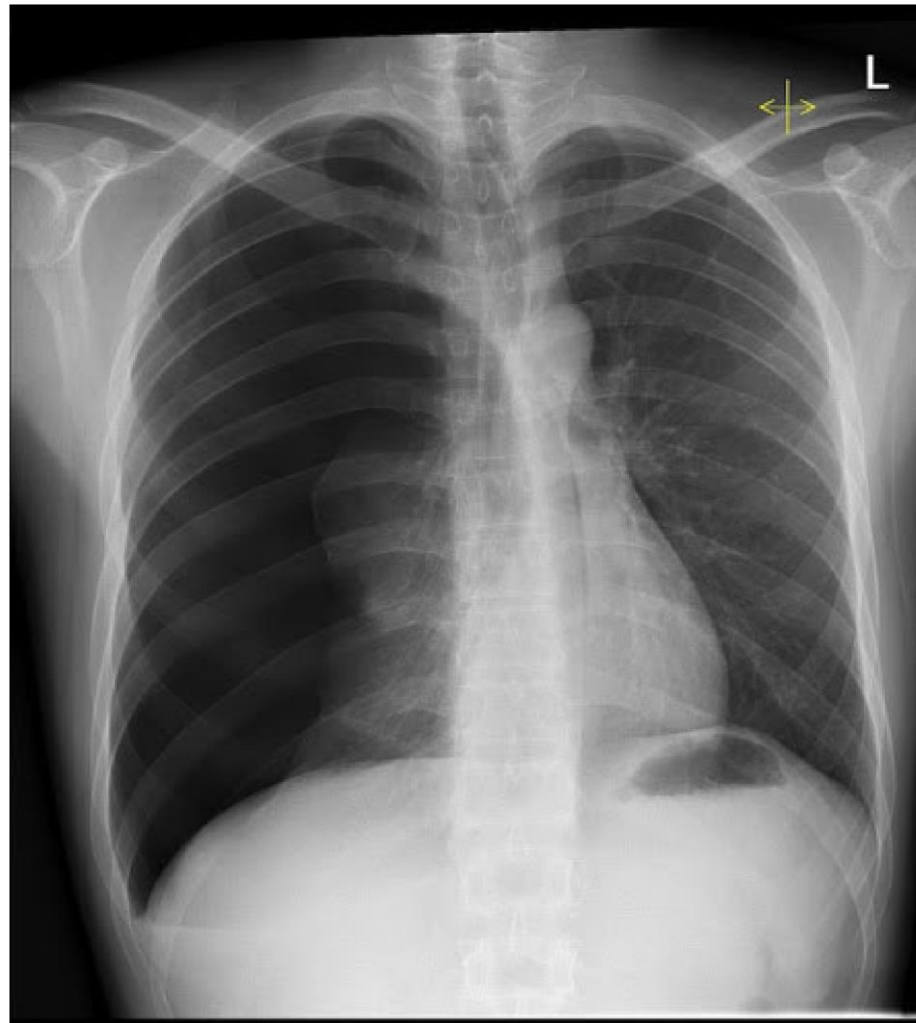


Figure 7.2: Pneumothorax X-ray image

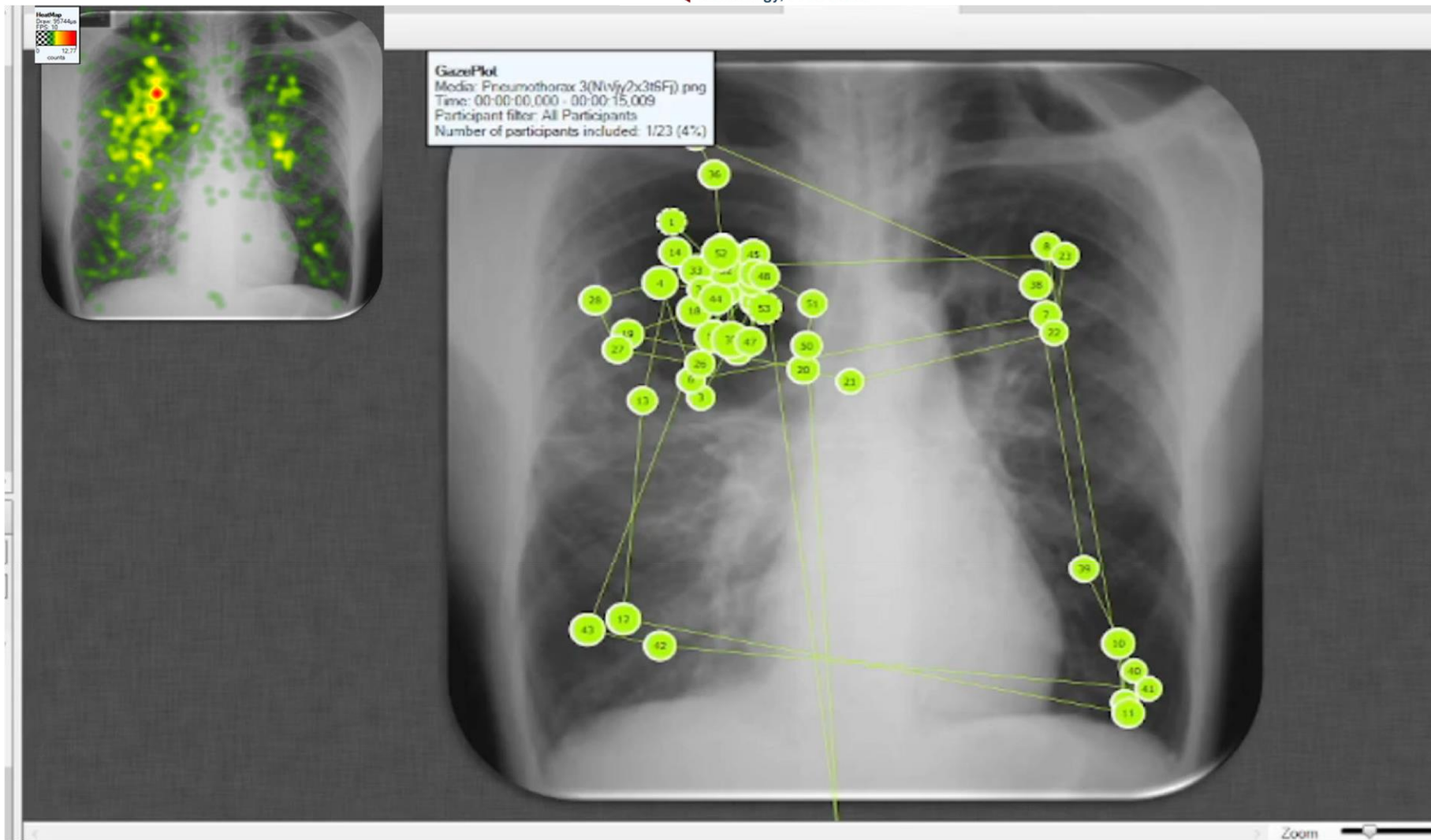


Figure 7.3: Heat maps and gaze plots on pneumothorax X-ray image

8. Pneumo-haemothorax



Figure 8.1: Pneumo-haemothorax X-ray image

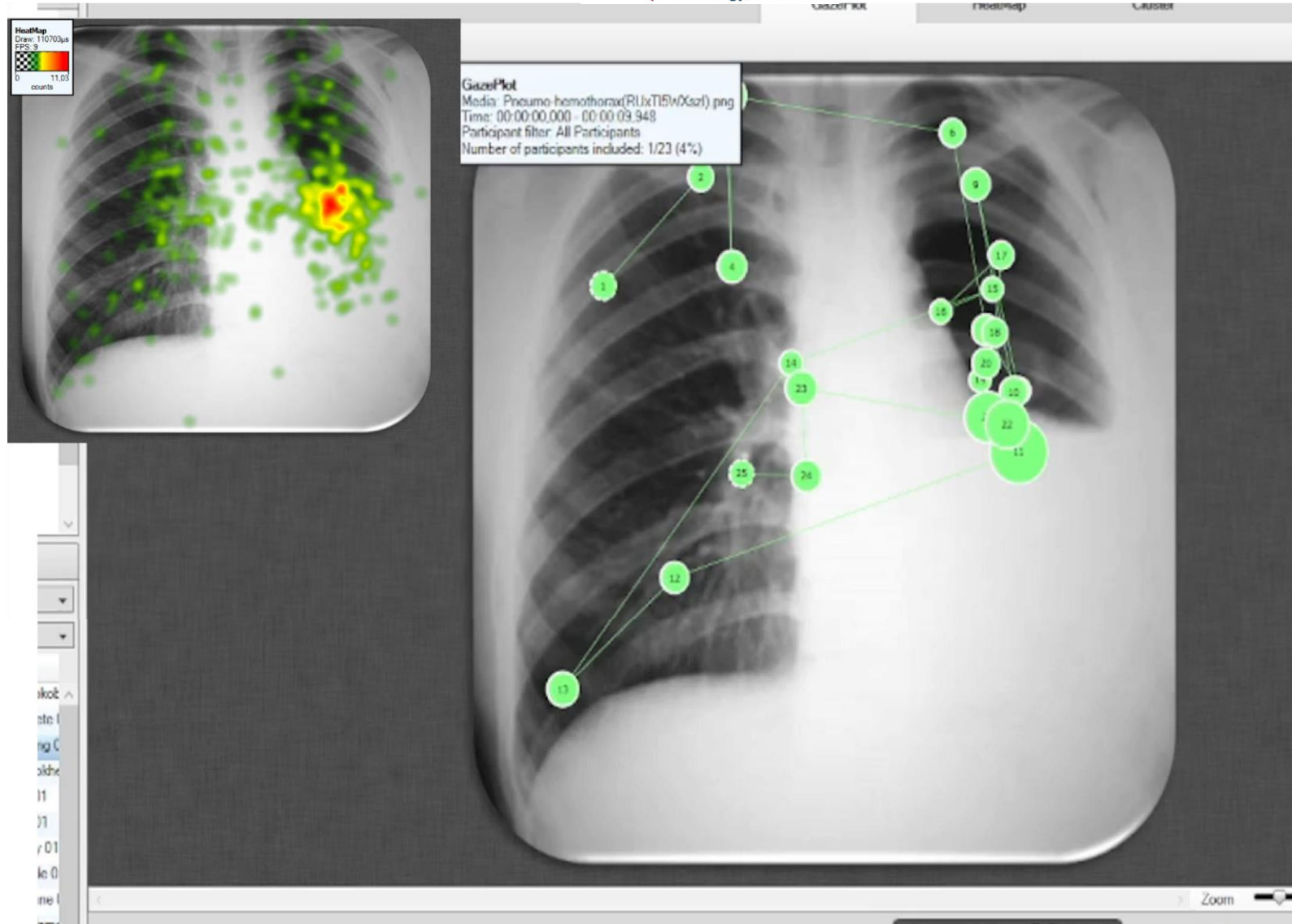


Figure 8.2: Heat maps and gaze plots on pneumo-haemothorax X-ray image

Appendix H – Novices’ after-training results

1. Introduction

This appendix documents the novices’ results after the training. It demonstrates the results of the 17 chest X-ray images that were analysed by novice radiographers. The novices were given 17 chest X-ray images to analyse. The gaze behaviour of the novices was examined to ensure that they visited the correct areas and to ensure that they correctly identified the pathology.

The results for each image analysed are shown in the tables below. The first table presented the following results:

The participants were required to compare the two lungs by fixating on both lungs and to evaluate the costophrenic angles by visiting the left and right costophrenic angles at least once. They had to make sure that costophrenic angles were entirely exposed. They were also required to have visited the AOI at least once – this is the area where the pathology is present. Participants were presented with questionnaires based on the pathology found on each chest X-ray image. They had to identify the pathology present on the images. Each participant’s answers were recorded on a paper-based answering sheet as they analysed the chest X-ray images. The answering sheets are represented in Section 3.3.10 and the full sheet is presented in Appendix B.

The second table recorded the participants’ 1-tail t-tests results that were gathered from eye-tracking analysis. Time to First Fixation represents the time it takes for the participants to fixate on the AOI for the first time the stimulus is displayed. The AOI is the area on the chest X-ray where the pathology is present. Inverse of Time to First Fixation ($V = 1/t$) measures the speed, a higher V value indicates a fast fixation on the pathology. A higher V value for fixation duration indicates that the observer spent a short time fixating on the pathology. Absolute Deviation from

Average V ($ABS(V-AVG)$) for Time to First Fixation and Fixation Duration, determines the extent that each participant's performance differs from the average V value. It helps in the identification of outliers. Fixation Duration represents participants' fixation durations within the AOI. The AOI is the area on the chest X-ray where the pathology is present. ABS after outliers were removed column indicates data that was removed due to extreme values that could potentially affect the results.

These results were referenced in Section 3.3.8 and the criteria in Section 3.3.6. The chest X-ray images that were analysed are presented in Appendix A, and the AOI were referenced in Appendix D.

The data that contained outliers was specifically identified with a red background colour and font and the 1-tail t-test tables showed that the outliers had been eliminated. Similarly, for the chi-square tables, "yes" responses were shown with a green background, while "no" responses were shown with a red background.

2. Lung Cancer

Table 2.1 Participants' chi-square results when analysing Lung Cancer image (Figure 4.1 in Appendix A)

Participants	Criteria			
	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	Yes	Yes
Participant 2	No	Yes	Yes	Yes
Participant 3	Yes	Yes	Yes	Yes
Participant 4	No	No	No	Yes
Participant 5	No	No	Yes	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	No	Yes	Yes	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	No	Yes	Yes	Yes
Participant 11	No	Yes	Yes	No
Participant 12	Yes	Yes	Yes	Yes
Participant 13	No	Yes	Yes	No
Participant 14	No	Yes	Yes	Yes
Participant 15	No	Yes	Yes	Yes
Participant 16	Yes	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 17	Yes	Yes	Yes	Yes
Participant 18	Yes	Yes	Yes	Yes
Participant 19	No	Yes	Yes	Yes
Participant 20	No	Yes	Yes	Yes
Participant 21	No	Yes	No	No
Participant 22	No	Yes	Yes	Yes
Participant 23	No	Yes	Yes	Yes
Participant 24	No	Yes	No	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	Yes	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	No	Yes	Yes	Yes
Participant 31	No	Yes	Yes	Yes
Participant 32	Yes	No	No	Yes
Participant 33	Yes	Yes	Yes	Yes
Participant 34	No	Yes	Yes	Yes
Participant 35	No	Yes	Yes	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 36	No	Yes	Yes	Yes
Participant 37	Yes	Yes	Yes	Yes
Participant 38	No	Yes	Yes	Yes
Participant 39	No	Yes	No	Yes
Participant 40	No	Yes	Yes	Yes

Table 2.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on Lung Cancer image (Figure 4.1 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.70	1.43	0.47	2.01	0.50	0.56	0.50
Participant 2	0.00		0.96	2.64	0.38	0.67	0.38
Participant 3	6.53	0.15	0.80	1.26	0.79	0.26	0.79
Participant 4	5.25	0.19	0.77	1.85	0.54	0.51	0.54
Participant 5	0.49	2.04	1.08	0.33	3.03	1.98	3.03
Participant 6	3.48	0.29	0.67	0.27	3.70	2.65	3.70
Participant 7	3.50	0.29	0.67	1.05	0.95	0.10	0.95
Participant 8	3.98	0.25	0.71	0.58	1.72	0.67	1.72
Participant 9	0.69	1.45	0.49	0.17	5.88	4.83	
Participant 10	0.54	1.85	0.89	1.61	0.62	0.43	0.62
Participant 11	1.38	0.72	0.23	1.14	0.88	0.18	0.88
Participant 12	2.02	0.50	0.46	4.34	0.23	0.82	0.23
Participant 13	1.12	0.89	0.06	1.31	0.76	0.29	0.76
Participant 14	14.13	0.07	0.89	0.17	5.88	4.83	
Participant 15	5.41	0.18	0.77	5.6	0.18	0.87	0.18
Participant 16	3.67	0.27	0.69	3.52	0.28	0.77	0.28
Participant 17	2.44	0.41	0.55	4.87	0.21	0.85	0.21

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.70	1.43	0.47	6.31	0.16	0.89	0.16
Participant 19	0.28	3.57	2.61	0.72	1.39	0.34	1.39
Participant 20	0.68	1.47	0.51	4.11	0.24	0.81	0.24
Participant 21	6.18	0.16	0.80	3.12	0.32	0.73	0.32
Participant 22	0.41	2.44	1.48	6.91	0.14	0.91	0.14
Participant 23	0.00		0.96	0		1.05	
Participant 24	11.47	0.09	0.87	0.37	2.70	1.65	2.70
Participant 25	3.05	0.33	0.63	1.54	0.65	0.40	0.65
Participant 26	0.00		0.96	0		1.05	
Participant 27	5.81	0.17	0.79	1.15	0.87	0.18	0.87
Participant 28	1.78	0.56	0.40	6.96	0.14	0.91	0.14
Participant 29	0.60	1.67	0.71	1.33	0.75	0.30	0.75
Participant 30	1.69	0.59	0.37	0.93	1.08	0.02	1.08
Participant 31	0.41	2.44	1.48	1.16	0.86	0.19	0.86
Participant 32	0.97	1.03	0.07	3.2	0.31	0.74	0.31
Participant 33	0.50	2.00	1.04	5.76	0.17	0.88	0.17
Participant 34	5.08	0.20	0.76	1.69	0.59	0.46	0.59
Participant 35	0.49	2.04	1.08	1.24	0.81	0.25	0.81

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.71	1.41	0.45	5.17	0.19	0.86	0.19
Participant 37	6.49	0.15	0.80	3.34	0.30	0.75	0.30
Participant 38	0.65	1.54	0.58	3.15	0.32	0.74	0.32
Participant 39	0.00		0.96	0		1.05	
Participant 40	4.95	0.20	0.76	2.45	0.41	0.64	0.41
Average	2.71	0.96	0.77	2.33	1.05	0.93	0.78
STDEV		0.88			1.42		
3*STDEV		2.64			4.27		

Table 2.3 Participants' chi-square results when analysing Lung Cancer image (Figure 4.2 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	Yes	No	Yes
Participant 4	Yes	Yes	No	Yes
Participant 5	Yes	Yes	No	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	Yes	Yes	No	Yes
Participant 9	Yes	No	No	Yes
Participant 10	Yes	Yes	Yes	Yes
Participant 11	Yes	Yes	Yes	Yes
Participant 12	Yes	Yes	No	Yes
Participant 13	Yes	Yes	No	Yes
Participant 14	Yes	Yes	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	Yes	No	Yes
Participant 17	Yes	No	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	Yes	No	Yes
Participant 20	Yes	Yes	Yes	Yes
Participant 21	Yes	Yes	No	Yes
Participant 22	Yes	Yes	No	Yes
Participant 23	Yes	Yes	No	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	Yes	Yes	No	Yes
Participant 27	No	Yes	No	Yes
Participant 28	Yes	Yes	Yes	Yes
Participant 29	Yes	Yes	Yes	Yes
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	Yes	Yes	Yes
Participant 32	Yes	No	No	Yes
Participant 33	Yes	Yes	Yes	Yes
Participant 34	Yes	Yes	No	Yes
Participant 35	Yes	Yes	No	Yes
Participant 36	Yes	No	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 37	Yes	No	No	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	Yes	No	Yes

Table 2.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on Lung Cancer image (Figure 4.2 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.51	1.96	0.11	2.06	0.49	0.06	0.49
Participant 2	1.83	0.55	1.31	4.27	0.23	0.19	0.23
Participant 3	0.42	2.38	0.53	2.4	0.42	0.00	0.42
Participant 4	0.63	1.59	0.27	2.06	0.49	0.06	0.49
Participant 5	0.56	1.79	0.07	2.02	0.50	0.07	0.50
Participant 6	1.25	0.80	1.05	1.52	0.66	0.24	0.66
Participant 7	2.26	0.44	1.41	5.98	0.17	0.25	0.17
Participant 8	0.41	2.44	0.59	2.31	0.43	0.01	0.43
Participant 9	0.69	1.45	0.40	2.28	0.44	0.02	0.44
Participant 10	0.51	1.96	0.11	2.5	0.40	0.02	0.40
Participant 11	0.92	1.09	0.77	3.71	0.27	0.15	0.27
Participant 12	0.4	2.50	0.65	1.63	0.61	0.19	0.61
Participant 13	1.19	0.84	1.01	2.34	0.43	0.01	0.43
Participant 14	1.57	0.64	1.22	2.41	0.41	0.01	0.41
Participant 15	4.51	0.22	1.63	4.64	0.22	0.21	0.22
Participant 16	0.69	1.45	0.40	2.08	0.48	0.06	0.48
Participant 17	0.65	1.54	0.31	1.93	0.52	0.10	0.52

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.47	2.13	0.27	1.57	0.64	0.22	0.64
Participant 19	0.23	4.35	2.49	1.47	0.68	0.26	0.68
Participant 20	0.37	2.70	0.85	2.14	0.47	0.05	0.47
Participant 21	3.9	0.26	1.60	2.52	0.40	0.02	0.40
Participant 22	0.44	2.27	0.42	3.52	0.28	0.14	0.28
Participant 23	6.32	0.16	1.69	4.05	0.25	0.17	0.25
Participant 24	0.48	2.08	0.23	6.42	0.16	0.27	0.16
Participant 25	0.67	1.49	0.36	2.39	0.42	0.00	0.42
Participant 26	0.54	1.85	0.00	2.34	0.43	0.01	0.43
Participant 27	0.31	3.23	1.37	1.35	0.74	0.32	0.74
Participant 28	0.53	1.89	0.03	1.34	0.75	0.32	0.75
Participant 29	0.6	1.67	0.19	3.61	0.28	0.14	0.28
Participant 30	0.47	2.13	0.27	9.81	0.10	0.32	0.10
Participant 31	0.27	3.70	1.85	8.6	0.12	0.31	0.12
Participant 32	0.78	1.28	0.57	0.7	1.43	1.01	
Participant 33	0.3	3.33	1.48	3.71	0.27	0.15	0.27
Participant 34	0.33	3.03	1.18	2.13	0.47	0.05	0.47
Participant 35	0.29	3.45	1.60	3.09	0.32	0.10	0.32

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.49	2.04	0.19	2.81	0.36	0.07	0.36
Participant 37	0.84	1.19	0.66	3.45	0.29	0.13	0.29
Participant 38	0.81	1.23	0.62	4.25	0.24	0.19	0.24
Participant 39	0.33	3.03	1.18	1.91	0.52	0.10	0.52
Participant 40	0.5	2.00	0.15	8.48	0.12	0.30	0.12
Average	0.98	1.85	0.78	3.20	0.42	0.16	0.40
STDEV		1.00			0.23		
3*STDEV		3.00			0.70		

Table 2.5 Participants' chi-square results when analysing Lung Cancer image (Figure 4.3 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	Yes	No	Yes
Participant 4	No	Yes	No	Yes
Participant 5	No	Yes	Yes	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	Yes	Yes	Yes	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	No	Yes	Yes	Yes
Participant 11	Yes	Yes	Yes	Yes
Participant 12	Yes	Yes	Yes	Yes
Participant 13	Yes	Yes	No	Yes
Participant 14	Yes	Yes	No	Yes
Participant 15	No	Yes	No	Yes
Participant 16	Yes	Yes	No	Yes
Participant 17	Yes	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	Yes	No	Yes
Participant 20	Yes	Yes	No	Yes
Participant 21	Yes	Yes	No	Yes
Participant 22	Yes	Yes	Yes	Yes
Participant 23	Yes	Yes	Yes	Yes
Participant 24	Yes	Yes	No	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	Yes	Yes	No	Yes
Participant 27	Yes	Yes	No	Yes
Participant 28	Yes	Yes	Yes	Yes
Participant 29	Yes	Yes	No	Yes
Participant 30	Yes	Yes	No	Yes
Participant 31	No	Yes	Yes	Yes
Participant 32	Yes	No	No	Yes
Participant 33	Yes	Yes	No	Yes
Participant 34	Yes	Yes	No	Yes
Participant 35	Yes	Yes	No	Yes
Participant 36	Yes	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 37	Yes	No	No	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	Yes	Yes	Yes	Yes
Participant 40	Yes	Yes	No	Yes

Table 2.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on Lung Cancer image (Figure 4.3 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.44	2.27	0.43	2.16	0.46	0.14	0.46
Participant 2	1	1.00	0.84	4.2	0.24	0.37	0.24
Participant 3	0.48	2.08	0.24	1.63	0.61	0.01	0.61
Participant 4	0.69	1.45	0.39	1.05	0.95	0.35	0.95
Participant 5	1.37	0.73	1.11	0.94	1.06	0.46	1.06
Participant 6	1.05	0.95	0.89	1.55	0.65	0.04	0.65
Participant 7	0.49	2.04	0.20	3.26	0.31	0.30	0.31
Participant 8	0.39	2.56	0.72	2.47	0.40	0.20	0.40
Participant 9	0.49	2.04	0.20	0.77	1.30	0.69	1.30
Participant 10	0.49	2.04	0.20	2.14	0.47	0.14	0.47
Participant 11	4.37	0.23	1.61	4.34	0.23	0.37	0.23
Participant 12	0.36	2.78	0.94	1.08	0.93	0.32	0.93
Participant 13	0.46	2.17	0.33	1.53	0.65	0.05	0.65
Participant 14	0.6	1.67	0.18	2.71	0.37	0.24	0.37
Participant 15	0.98	1.02	0.82	7.97	0.13	0.48	0.13
Participant 16	0.57	1.75	0.09	2.48	0.40	0.20	0.40
Participant 17	0.45	2.22	0.38	0.97	1.03	0.43	1.03

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.43	2.33	0.48	0.46	2.17	1.57	
Participant 19	0.41	2.44	0.60	0.79	1.27	0.66	1.27
Participant 20	0.45	2.22	0.38	2.1	0.48	0.13	0.48
Participant 21	1.47	0.68	1.16	1.48	0.68	0.07	0.68
Participant 22	0.74	1.35	0.49	5.23	0.19	0.41	0.19
Participant 23	5.81	0.17	1.67	3.95	0.25	0.35	0.25
Participant 24	0.41	2.44	0.60	1.73	0.58	0.03	0.58
Participant 25	0.53	1.89	0.04	2.15	0.47	0.14	0.47
Participant 26	0.48	2.08	0.24	2.72	0.37	0.24	0.37
Participant 27	0.43	2.33	0.48	0.82	1.22	0.61	1.22
Participant 28	0.36	2.78	0.94	1.89	0.53	0.08	0.53
Participant 29	0.9	1.11	0.73	1.12	0.89	0.29	0.89
Participant 30	0.43	2.33	0.48	3.29	0.30	0.30	0.30
Participant 31	0.47	2.13	0.29	5.1	0.20	0.41	0.20
Participant 32	0.49	2.04	0.20	1.26	0.79	0.19	0.79
Participant 33	0.32	3.13	1.28	3.05	0.33	0.28	0.33
Participant 34	0.28	3.57	1.73	2.84	0.35	0.25	0.35
Participant 35	0.48	2.08	0.24	1.63	0.61	0.01	0.61

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.43	2.33	0.48	2.18	0.46	0.15	0.46
Participant 37	0.49	2.04	0.20	3.09	0.32	0.28	0.32
Participant 38	6.1	0.16	1.68	1.97	0.51	0.10	0.51
Participant 39	1.14	0.88	0.97	1.12	0.89	0.29	0.89
Participant 40	0.46	2.17	0.33	6.15	0.16	0.44	0.16
Average	0.95	1.84	0.63	2.43	0.61	0.30	0.57
STDEV		0.79			0.41		
3*STDEV		2.38			1.22		

3. Pneumonia

Table 3.1 Participants' chi-square results when analysing pneumonia image (Figure 4.4 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	Yes	Yes
Participant 2	No	Yes	Yes	Yes
Participant 3	No	Yes	No	Yes
Participant 4	Yes	Yes	Yes	Yes
Participant 5	No	Yes	Yes	Yes
Participant 6	No	Yes	Yes	Yes
Participant 7	No	Yes	No	Yes
Participant 8	Yes	Yes	Yes	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	No	Yes	Yes	Yes
Participant 11	No	Yes	No	No
Participant 12	Yes	Yes	Yes	Yes
Participant 13	No	Yes	No	Yes
Participant 14	No	Yes	Yes	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	No	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 17	Yes	Yes	No	Yes
Participant 18	No	Yes	No	Yes
Participant 19	No	Yes	Yes	Yes
Participant 20	No	Yes	Yes	Yes
Participant 21	No	Yes	Yes	No
Participant 22	No	Yes	Yes	Yes
Participant 23	No	Yes	Yes	Yes
Participant 24	No	Yes	No	Yes
Participant 25	No	Yes	No	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	No	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	No	Yes	Yes	Yes
Participant 31	No	No	Yes	No
Participant 32	No	No	No	No
Participant 33	No	Yes	Yes	Yes
Participant 34	No	Yes	Yes	Yes
Participant 35	No	Yes	Yes	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 36	No	Yes	Yes	Yes
Participant 37	Yes	Yes	Yes	Yes
Participant 38	No	Yes	Yes	Yes
Participant 39	No	Yes	Yes	Yes
Participant 40	No	Yes	Yes	Yes

Table 3.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumonia image (Figure 4.4 in Appendix A)

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
1	0.27	3.70	0.92	3.70	1.25	0.80	1.47	0.80	0.55	1.82	0.72	1.82	0.85	1.18	0.23	1.18
2	0.23	4.35	1.56	4.35	3.35	0.30	1.98	0.30	4.04	0.25	0.85	0.25	2.24	0.45	0.96	0.45
3	1.72	0.58	2.20	0.58	1.23	0.81	1.46	0.81	2.47	0.40	0.69	0.40	0.92	1.09	0.32	1.09
4	10.47	0.10	2.69	0.10	1.02	0.98	1.29	0.98	1.11	0.90	0.20	0.90	3.86	0.26	1.15	0.26
5	0.29	3.45	0.66	3.45	0.09	11.11	8.84		4.48	0.22	0.88	0.22	0.32	3.13	1.72	3.13
6	0.25	4.00	1.21	4.00	0.13	7.69	5.42	7.69	0		1.10		0		1.41	
7	6.86	0.15	2.64	0.15	0.26	3.85	1.57	3.85	1.44	0.69	0.40	0.69	1.03	0.97	0.44	0.97
8	3.95	0.25	2.53	0.25	0.83	1.20	1.07	1.20	1.45	0.69	0.41	0.69	0.81	1.23	0.17	1.23
9	0.72	1.39	1.40	1.39	1.46	0.68	1.59	0.68	1.95	0.51	0.59	0.51	1.45	0.69	0.72	0.69

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
10	1.94	0.52	2.27	0.52	0.75	1.33	0.94	1.33	1.79	0.56	0.54	0.56	0.92	1.09	0.32	1.09
11	0.25	4.00	1.21	4.00	1.11	0.90	1.37	0.90	6.03	0.17	0.93	0.17	3.64	0.27	1.13	0.27
12	1.5	0.67	2.12	0.67	1.39	0.72	1.56	0.72	0.75	1.33	0.23	1.33	3.48	0.29	1.12	0.29
13	0.32	3.13	0.34	3.13	0.51	1.96	0.31	1.96	5.14	0.19	0.90	0.19	0.52	1.92	0.52	1.92
14	2.51	0.40	2.39	0.40	0.2	5.00	2.73	5.00	11.35	0.09	1.01	0.09	0.09	11.11	9.70	
15	0.24	4.17	1.38	4.17	1.43	0.70	1.58	0.70	4.03	0.25	0.85	0.25	3.64	0.27	1.13	0.27
16	0.25	4.00	1.21	4.00	1.25	0.80	1.47	0.80	4.07	0.25	0.85	0.25	0.42	2.38	0.97	2.38
17	1.85	0.54	2.24	0.54	0.97	1.03	1.24	1.03	0.42	2.38	1.28	2.38	6.31	0.16	1.25	0.16
18	0		2.79		0		2.27		0.55	1.82	0.72	1.82	2.37	0.42	0.98	0.42
19	0.04	25.00	22.21		0.43	2.33	0.05	2.33	0.22	4.55	3.45		0.72	1.39	0.02	1.39
20	0.29	3.45	0.66	3.45	0.49	2.04	0.23	2.04	0.47	2.13	1.03	2.13	1.34	0.75	0.66	0.75

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
21	0.24	4.17	1.38	4.17	1.49	0.67	1.60	0.67	7.56	0.13	0.97	0.13	2.67	0.37	1.03	0.37
22	5.7	0.18	2.61	0.18	0.22	4.55	2.27	4.55	1	1.00	0.10	1.00	0.27	3.70	2.30	3.70
23	0		2.79		0		2.27		0		1.10		0		1.41	
24	13.81	0.07	2.71	0.07	0.16	6.25	3.98	6.25	7.04	0.14	0.96	0.14	0.33	3.03	1.62	3.03
25	0.17	5.88	3.10	5.88	0.38	2.63	0.36	2.63	3.65	0.27	0.83	0.27	2.54	0.39	1.01	0.39
26	0		2.79		0		2.27		0.55	1.82	0.72	1.82	0.92	1.09	0.32	1.09
27	0.21	4.76	1.98	4.76	0.26	3.85	1.57	3.85	6.77	0.15	0.95	0.15	0.32	3.13	1.72	3.13
28	1.74	0.57	2.21	0.57	0.29	3.45	1.17	3.45	0.71	1.41	0.31	1.41	0.94	1.06	0.34	1.06
29	1.19	0.84	1.95	0.84	4.32	0.23	2.04	0.23	0.79	1.27	0.17	1.27	2.59	0.39	1.02	0.39
30	0		2.79		2.14	0.47	1.81	0.47	3.95	0.25	0.85	0.25	5.07	0.20	1.21	0.20
31	0.44	2.27	0.51	2.27	1.03	0.97	1.30	0.97	6.91	0.14	0.95	0.14	1.35	0.74	0.67	0.74

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
32	0		2.79		0.63	1.59	0.69	1.59	0.28	3.57	2.47	3.57	4.11	0.24	1.16	0.24
33	6.49	0.15	2.63	0.15	0.85	1.18	1.10	1.18	0.69	1.45	0.35	1.45	5.39	0.19	1.22	0.19
34	11.28	0.09	2.70	0.09	1.15	0.87	1.41	0.87	0.52	1.92	0.82	1.92	0.3	3.33	1.93	3.33
35	0.21	4.76	1.98	4.76	0.18	5.56	3.28	5.56	0.42	2.38	1.28	2.38	0.32	3.13	1.72	3.13
36	0		2.79		0		2.27		0		1.10		3.31	0.30	1.10	0.30
37	11.54	0.09	2.70	0.09	0.81	1.23	1.04	1.23	4.61	0.22	0.88	0.22	0.74	1.35	0.06	1.35
38	0		2.79		0.56	1.79	0.49	1.79	0.58	1.72	0.62	1.72	1.81	0.55	0.85	0.55
39	10.95	0.09	2.69	0.09	0.68	1.47	0.80	1.47	0.29	3.45	2.35	3.45	1.22	0.82	0.59	0.82
40	0.24	4.17	1.38	4.17	1.11	0.90	1.37	0.90	5.89	0.17	0.93	0.17	2.58	0.39	1.02	0.39
Average	2.45	2.79	2.55	2.09	0.86	2.27	1.79	2.02	2.61	1.10	0.91	1.00	1.79	1.41	1.18	1.14

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
STDEV			3.28			2.37				1.11				1.93		
3*STDEV			9.84			7.12				3.34				5.78		

Table 4.3 Participants' chi-square results when analysing pneumonia image (Figure 4.15 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	No	Yes	No	Yes
Participant 2	No	Yes	No	Yes
Participant 3	No	Yes	No	Yes
Participant 4	No	Yes	No	Yes
Participant 5	Yes	Yes	No	Yes
Participant 6	No	Yes	Yes	Yes
Participant 7	No	Yes	No	Yes
Participant 8	No	Yes	No	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	No	Yes	No	Yes
Participant 11	No	Yes	Yes	Yes
Participant 12	Yes	Yes	Yes	Yes
Participant 13	No	Yes	Yes	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	No	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 17	No	Yes	No	Yes
Participant 18	No	Yes	Yes	Yes
Participant 19	No	Yes	No	Yes
Participant 20	No	Yes	Yes	Yes
Participant 21	No	Yes	No	Yes
Participant 22	No	Yes	Yes	Yes
Participant 23	No	Yes	No	Yes
Participant 24	No	Yes	Yes	Yes
Participant 25	No	Yes	No	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	No	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	No	Yes	No	Yes
Participant 31	No	Yes	Yes	Yes
Participant 32	No	Yes	No	Yes
Participant 33	No	Yes	Yes	Yes
Participant 34	No	Yes	Yes	No
Participant 35	No	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 36	No	Yes	Yes	Yes
Participant 37	No	Yes	Yes	Yes
Participant 38	No	Yes	No	No
Participant 39	No	Yes	Yes	Yes
Participant 40	No	Yes	No	Yes

Table 3.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumonia image (Figure 4.15 in Appendix A)

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
1	0.76	1.32	4.17	1.32	1.4	0.71	0.12	0.71	0.56	1.79	1.14	1.79	1.13	0.88	0.39	0.88
2	3.83	0.26	5.22	0.26	4.05	0.25	0.59	0.25	2.07	0.48	0.17	0.48	1.43	0.70	0.58	0.70
3	0		5.48		1.34	0.75	0.09	0.75	7.72	0.13	0.52	0.13	0.37	2.70	1.42	2.70
4	0.43	2.33	3.16	2.33	1.88	0.53	0.30	0.53	0.77	1.30	0.65	1.30	0.9	1.11	0.17	1.11
5	3.78	0.26	5.22	0.26	1.64	0.61	0.22	0.61	0.74	1.35	0.70	1.35	0.48	2.08	0.80	2.08
6	0		5.48		0.59	1.69	0.86	1.69	3.67	0.27	0.38	0.27	0.36	2.78	1.50	2.78
7	4.03	0.25	5.24	0.25	1.44	0.69	0.14	0.69	5.09	0.20	0.45	0.20	0.72	1.39	0.11	1.39
8	1.18	0.85	4.64	0.85	1.55	0.65	0.19	0.65	1.97	0.51	0.14	0.51	1.46	0.68	0.59	0.68
9	0.55	1.82	3.67	1.82	3.73	0.27	0.56	0.27	3.37	0.30	0.35	0.30	1.52	0.66	0.62	0.66
10	2.62	0.38	5.10	0.38	1.32	0.76	0.07	0.76	9.17	0.11	0.54	0.11	0.66	1.52	0.24	1.52

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
11	4.37	0.23	5.25	0.23	4.99	0.20	0.63	0.20	7.93	0.13	0.52	0.13	2.31	0.43	0.85	0.43
12	0.01	100.00	94.52		3.7	0.27	0.56	0.27	0.63	1.59	0.94	1.59	0.7	1.43	0.15	1.43
13	0.3	3.33	2.15	3.33	1.13	0.88	0.05	0.88	0.77	1.30	0.65	1.30	0.72	1.39	0.11	1.39
14	0.08	12.50	7.02	12.50	1.85	0.54	0.29	0.54	5.16	0.19	0.46	0.19	0.61	1.64	0.36	1.64
15	0.09	11.11	5.63	11.11	1.51	0.66	0.17	0.66	4.03	0.25	0.40	0.25	2.34	0.43	0.85	0.43
16	0.23	4.35	1.14	4.35	3.04	0.33	0.50	0.33	3.78	0.26	0.38	0.26	0.96	1.04	0.24	1.04
17	0.53	1.89	3.60	1.89	1.5	0.67	0.17	0.67	4.72	0.21	0.44	0.21	3.57	0.28	1.00	0.28
18	1.3	0.77	4.71	0.77	0.99	1.01	0.18	1.01	1.05	0.95	0.30	0.95	1.18	0.85	0.43	0.85
19	5.37	0.19	5.30	0.19	2.05	0.49	0.34	0.49	0		0.65		0		1.28	
20	0.47	2.13	3.36	2.13	1.1	0.91	0.08	0.91	0.29	3.45	2.80		2.12	0.47	0.81	0.47
21	9.45	0.11	5.38	0.11	0.89	1.12	0.29	1.12	3.75	0.27	0.38	0.27	1.45	0.69	0.59	0.69

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
22	1.75	0.57	4.91	0.57	1.23	0.81	0.02	0.81	0.65	1.54	0.89	1.54	1.48	0.68	0.60	0.68
23	13.63	0.07	5.41	0.07	0.31	3.23	2.39		5.31	0.19	0.46	0.19	0.48	2.08	0.80	2.08
24	0.8	1.25	4.23	1.25	2.03	0.49	0.34	0.49	1.58	0.63	0.02	0.63	0.57	1.75	0.47	1.75
25	0		5.48		0.8	1.25	0.42	1.25	5.28	0.19	0.46	0.19	0.45	2.22	0.94	2.22
26	0.22	4.55	0.94	4.55	0.87	1.15	0.32	1.15	2.34	0.43	0.22	0.43	1.02	0.98	0.30	0.98
27	0		5.48		1.11	0.90	0.07	0.90	5.68	0.18	0.47	0.18	0.39	2.56	1.28	2.56
28	0.06	16.67	11.18	16.67	1.09	0.92	0.09	0.92	0.9	1.11	0.46	1.11	1.26	0.79	0.49	0.79
29	0.36	2.78	2.71	2.78	4.4	0.23	0.61	0.23	0.63	1.59	0.94	1.59	2.24	0.45	0.83	0.45
30	0.42	2.38	3.10	2.38	0.81	1.23	0.40	1.23	10.52	0.10	0.55	0.10	1.32	0.76	0.52	0.76
31	1.43	0.70	4.78	0.70	1.24	0.81	0.03	0.81	1.94	0.52	0.13	0.52	1.14	0.88	0.40	0.88
32	0.12	8.33	2.85	8.33	1.73	0.58	0.25	0.58	1.45	0.69	0.04	0.69	1.95	0.51	0.77	0.51

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
33	4.94	0.20	5.28	0.20	1.68	0.60	0.24	0.60	7.11	0.14	0.51	0.14	1.33	0.75	0.53	0.75
34	2.01	0.50	4.99	0.50	0.59	1.69	0.86	1.69	12.79	0.08	0.57	0.08	0.27	3.70	2.42	3.70
35	0		5.48		0		0.83		0		0.65		0		1.28	
36	0		5.48		2.57	0.39	0.44	0.39	3.32	0.30	0.35	0.30	1.62	0.62	0.66	0.62
37	3.82	0.26	5.22	0.26	1.33	0.75	0.08	0.75	4.71	0.21	0.44	0.21	0.58	1.72	0.44	1.72
38	7.04	0.14	5.34	0.14	0.47	2.13	1.30	2.13	4.45	0.22	0.42	0.22	0.62	1.61	0.33	1.61
39	0.53	1.89	3.60	1.89	1.67	0.60	0.23	0.60	11.1	0.09	0.56	0.09	0.56	1.79	0.51	1.79
40	0.48	2.08	3.40	2.08	1.4	0.71	0.12	0.71	0.69	1.45	0.80	1.45	0.62	1.61	0.33	1.61
Average	1.92	5.48	6.88	2.62	1.68	0.83	0.39	0.77	3.69	0.65	0.55	0.57	1.07	1.28	0.68	1.28

	Left								Right							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
STDEV		17.14				0.57				0.71				0.79		
3*STDEV		51.43				1.72				2.13				2.37		

Table 3.5 Participants' chi-square results when analysing pneumonia image (Figure 4.14 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	Yes	Yes
Participant 2	No	Yes	Yes	Yes
Participant 3	Yes	Yes	No	Yes
Participant 4	Yes	Yes	Yes	Yes
Participant 5	No	Yes	Yes	Yes
Participant 6	No	Yes	Yes	Yes
Participant 7	Yes	Yes	Yes	Yes
Participant 8	Yes	Yes	Yes	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	No	Yes	Yes	Yes
Participant 11	Yes	Yes	No	Yes
Participant 12	No	Yes	Yes	Yes
Participant 13	Yes	Yes	Yes	Yes
Participant 14	No	Yes	Yes	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	Yes	Yes	Yes
Participant 17	No	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 18	No	Yes	No	Yes
Participant 19	Yes	Yes	Yes	Yes
Participant 20	No	Yes	Yes	Yes
Participant 21	No	Yes	No	Yes
Participant 22	Yes	Yes	Yes	Yes
Participant 23	No	Yes	No	Yes
Participant 24	No	Yes	No	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	No	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	Yes	Yes	Yes	Yes
Participant 31	Yes	Yes	Yes	Yes
Participant 32	Yes	No	No	Yes
Participant 33	No	Yes	Yes	Yes
Participant 34	No	Yes	Yes	Yes
Participant 35	Yes	Yes	No	Yes
Participant 36	Yes	Yes	Yes	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 37	No	Yes	Yes	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	Yes	Yes	Yes	Yes
Participant 40	Yes	Yes	No	Yes

Table 3.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumonia image (Figure 4.14 in

Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.24	4.17	1.66	4.17	1.4	0.71	0.11	0.71
Participant 2	2.49	0.40	2.11	0.40	1.58	0.63	0.19	0.63
Participant 3	0		2.51		1.63	0.61	0.21	0.61
Participant 4	0.27	3.70	1.20	3.70	3.11	0.32	0.50	0.32
Participant 5	12.44	0.08	2.43	0.08	0.13	7.69	6.87	
Participant 6	0.57	1.75	0.75	1.75	0.78	1.28	0.46	1.28
Participant 7	2.92	0.34	2.17	0.34	3.44	0.29	0.53	0.29
Participant 8	0.83	1.20	1.30	1.20	2.11	0.47	0.35	0.47
Participant 9	0.86	1.16	1.34	1.16	1.64	0.61	0.21	0.61
Participant 10	2.94	0.34	2.17	0.34	0.67	1.49	0.67	1.49
Participant 11	6.05	0.17	2.34	0.17	1.24	0.81	0.02	0.81
Participant 12	0		2.51		1.9	0.53	0.30	0.53
Participant 13	1.51	0.66	1.85	0.66	1.97	0.51	0.31	0.51
Participant 14	0.32	3.13	0.62	3.13	3.6	0.28	0.54	0.28
Participant 15	0.55	1.82	0.69	1.82	4.39	0.23	0.59	0.23
Participant 16	0.31	3.23	0.72	3.23	4.47	0.22	0.60	0.22
Participant 17	0.16	6.25	3.74	6.25	5.98	0.17	0.65	0.17

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.21	4.76	2.25	4.76	3.71	0.27	0.55	0.27
Participant 19	6.52	0.15	2.35	0.15	2.94	0.34	0.48	0.34
Participant 20	0.54	1.85	0.66	1.85	2.69	0.37	0.45	0.37
Participant 21	0.24	4.17	1.66	4.17	3.99	0.25	0.57	0.25
Participant 22	0.19	5.26	2.76	5.26	0.43	2.33	1.50	2.33
Participant 23	13.32	0.08	2.43	0.08	1.11	0.90	0.08	0.90
Participant 24	0.2	5.00	2.49	5.00	1	1.00	0.18	1.00
Participant 25	0		2.51		1.96	0.51	0.31	0.51
Participant 26	0.26	3.85	1.34	3.85	2.79	0.36	0.46	0.36
Participant 27	1.51	0.66	1.85	0.66	2.19	0.46	0.37	0.46
Participant 28	0.05	20.00	17.49		2.47	0.40	0.42	0.40
Participant 29	1.23	0.81	1.69	0.81	3.64	0.27	0.55	0.27
Participant 30	0.62	1.61	0.89	1.61	2.92	0.34	0.48	0.34
Participant 31	0.68	1.47	1.04	1.47	0.77	1.30	0.48	1.30
Participant 32	0		2.51		1.3	0.77	0.05	0.77
Participant 33	2.99	0.33	2.17	0.33	5.13	0.19	0.63	0.19
Participant 34	5.77	0.17	2.33	0.17	0.39	2.56	1.74	2.56
Participant 35	2.79	0.36	2.15	0.36	5.51	0.18	0.64	0.18

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0		2.51		5.2	0.19	0.63	0.19
Participant 37	0.22	4.55	2.04	4.55	4.35	0.23	0.59	0.23
Participant 38	13.71	0.07	2.43	0.07	0.95	1.05	0.23	1.05
Participant 39	0		2.51		0.74	1.35	0.53	1.35
Participant 40	0.59	1.69	0.81	1.69	2.6	0.38	0.44	0.38
Average	2.10	2.51	2.27	1.98	2.47	0.82	0.64	0.65
STDEV		3.60				1.24		
3*STDEV		10.79				3.73		

4. Normal

Table 4.1 Participants' chi-square results when analysing normal X-ray image (Figure 4.9 in Appendix A)

Participants	Criteria			
	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	Yes	N/A
Participant 2	No	Yes	No	N/A
Participant 3	No	Yes	Yes	N/A
Participant 4	Yes	Yes	Yes	N/A
Participant 5	No	Yes	No	N/A
Participant 6	Yes	No	Yes	N/A
Participant 7	No	Yes	No	N/A
Participant 8	No	Yes	No	N/A
Participant 9	No	Yes	Yes	N/A
Participant 10	Yes	Yes	Yes	N/A
Participant 11	No	Yes	Yes	N/A
Participant 12	Yes	Yes	Yes	N/A
Participant 13	No	Yes	Yes	N/A
Participant 14	No	Yes	No	N/A
Participant 15	Yes	Yes	Yes	N/A
Participant 16	Yes	Yes	No	N/A

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 17	No	Yes	No	N/A
Participant 18	No	Yes	No	N/A
Participant 19	No	Yes	No	N/A
Participant 20	Yes	Yes	Yes	N/A
Participant 21	No	Yes	Yes	N/A
Participant 22	No	Yes	No	N/A
Participant 23	No	Yes	Yes	N/A
Participant 24	Yes	Yes	No	N/A
Participant 25	Yes	Yes	Yes	N/A
Participant 26	Yes	Yes	Yes	N/A
Participant 27	Yes	Yes	Yes	N/A
Participant 28	No	Yes	Yes	N/A
Participant 29	Yes	Yes	No	N/A
Participant 30	No	Yes	Yes	N/A
Participant 31	Yes	Yes	Yes	N/A
Participant 32	No	Yes	No	N/A
Participant 33	No	Yes	Yes	N/A
Participant 34	No	Yes	No	N/A
Participant 35	Yes	Yes	Yes	N/A

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 36	No	Yes	Yes	N/A
Participant 37	Yes	Yes	Yes	N/A
Participant 38	Yes	Yes	Yes	N/A
Participant 39	No	Yes	Yes	N/A
Participant 40	Yes	Yes	Yes	N/A

Table 4.2 Participants' chi-square results when analysing normal X-ray image (Figure 4.8 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	No	Yes	Yes	N/A
Participant 2	No	Yes	Yes	N/A
Participant 3	No	Yes	Yes	N/A
Participant 4	Yes	Yes	Yes	N/A
Participant 5	No	Yes	Yes	N/A
Participant 6	Yes	Yes	Yes	N/A
Participant 7	No	Yes	No	N/A
Participant 8	No	Yes	No	N/A
Participant 9	No	Yes	No	N/A
Participant 10	No	Yes	Yes	N/A
Participant 11	Yes	Yes	Yes	N/A
Participant 12	Yes	Yes	Yes	N/A
Participant 13	No	Yes	Yes	N/A
Participant 14	No	Yes	Yes	N/A
Participant 15	No	Yes	No	N/A
Participant 16	Yes	Yes	Yes	N/A
Participant 17	No	Yes	No	N/A

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 18	No	Yes	Yes	N/A
Participant 19	Yes	Yes	Yes	N/A
Participant 20	Yes	Yes	No	N/A
Participant 21	No	Yes	Yes	N/A
Participant 22	No	Yes	Yes	N/A
Participant 23	No	Yes	No	N/A
Participant 24	Yes	Yes	No	N/A
Participant 25	No	Yes	Yes	N/A
Participant 26	Yes	Yes	Yes	N/A
Participant 27	No	Yes	Yes	N/A
Participant 28	Yes	Yes	Yes	N/A
Participant 29	Yes	Yes	Yes	N/A
Participant 30	Yes	Yes	Yes	N/A
Participant 31	Yes	Yes	Yes	N/A
Participant 32	No	Yes	No	N/A
Participant 33	Yes	Yes	Yes	N/A
Participant 34	Yes	Yes	Yes	N/A
Participant 35	Yes	Yes	Yes	N/A
Participant 36	No	Yes	Yes	N/A

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 37	No	Yes	Yes	N/A
Participant 38	No	Yes	Yes	N/A
Participant 39	No	Yes	No	N/A
Participant 40	Yes	Yes	No	N/A

5. Pneumo-haemothorax

Table 5.1 Participants' chi-square results when analysing pneumo-haemothorax image (Figure 4.7 in Appendix A)

Participants	Criteria			
	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	Yes	Yes
Participant 2	No	Yes	No	Yes
Participant 3	No	Yes	Yes	Yes
Participant 4	No	Yes	Yes	Yes
Participant 5	Yes	Yes	Yes	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	No	Yes	Yes	Yes
Participant 8	No	Yes	No	Yes
Participant 9	No	No	No	Yes
Participant 10	No	Yes	No	Yes
Participant 11	Yes	Yes	Yes	Yes
Participant 12	No	Yes	No	Yes
Participant 13	Yes	Yes	Yes	Yes
Participant 14	No	Yes	No	Yes
Participant 15	No	Yes	No	Yes
Participant 16	No	Yes	Yes	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 17	No	Yes	No	Yes
Participant 18	No	Yes	No	Yes
Participant 19	No	Yes	Yes	Yes
Participant 20	Yes	Yes	Yes	Yes
Participant 21	No	Yes	No	Yes
Participant 22	Yes	Yes	Yes	Yes
Participant 23	Yes	Yes	No	Yes
Participant 24	No	Yes	No	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	Yes	Yes	Yes	Yes
Participant 28	Yes	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	No	Yes	Yes	Yes
Participant 31	No	Yes	Yes	Yes
Participant 32	No	No	No	Yes
Participant 33	No	Yes	No	Yes
Participant 34	Yes	Yes	Yes	Yes
Participant 35	No	No	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 36	No	Yes	Yes	Yes
Participant 37	No	Yes	No	Yes
Participant 38	No	Yes	No	Yes
Participant 39	No	Yes	Yes	Yes
Participant 40	No	Yes	Yes	Yes

Table 5.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumo-haemothorax image

(Figure 4.7 in Appendix A)

Participants	Time to First Fixation on the	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 1	1.78	0.56	0.45	4.83	0.21	0.64	0.21
Participant 2	2.93	0.34	0.67	6.46	0.15	0.70	0.15
Participant 3	0.54	1.85	0.84	3.85	0.26	0.59	0.26
Participant 4	0.6	1.67	0.66	5.28	0.19	0.66	0.19
Participant 5	4.61	0.22	0.79	1.17	0.85	0.00	0.85
Participant 6	1.16	0.86	0.14	2.14	0.47	0.38	0.47
Participant 7	0.45	2.22	1.22	4.24	0.24	0.62	0.24
Participant 8	0.39	2.56	1.56	2.02	0.50	0.36	0.50
Participant 9	11.53	0.09	0.92	0.07	14.29	13.43	
Participant 10	0.77	1.30	0.29	4.27	0.23	0.62	0.23
Participant 11	3.28	0.30	0.70	5.27	0.19	0.66	0.19
Participant 12	2.84	0.35	0.65	3.83	0.26	0.59	0.26
Participant 13	7.92	0.13	0.88	0.88	1.14	0.29	1.14
Participant 14	1.35	0.74	0.27	0.82	1.22	0.37	1.22
Participant 15	2.16	0.46	0.54	3.33	0.30	0.55	0.30
Participant 16	2.37	0.42	0.59	4.27	0.23	0.62	0.23
Participant 17	0.9	1.11	0.10	2.08	0.48	0.37	0.48

Participants	Time to First Fixation on the	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.63	1.59	0.58	4.61	0.22	0.63	0.22
Participant 19	0.53	1.89	0.88	1.11	0.90	0.05	0.90
Participant 20	0.59	1.69	0.69	2.38	0.42	0.43	0.42
Participant 21	2.44	0.41	0.60	3.78	0.26	0.59	0.26
Participant 22	1.23	0.81	0.19	1.87	0.53	0.32	0.53
Participant 23	2.13	0.47	0.54	1.47	0.68	0.17	0.68
Participant 24	3.03	0.33	0.68	3.03	0.33	0.52	0.33
Participant 25	0.49	2.04	1.03	2.17	0.46	0.39	0.46
Participant 26	1.4	0.71	0.29	0.57	1.75	0.90	1.75
Participant 27	0.72	1.39	0.38	1.57	0.64	0.21	0.64
Participant 28	0.78	1.28	0.28	2.7	0.37	0.48	0.37
Participant 29	1.28	0.78	0.23	1.33	0.75	0.10	0.75
Participant 30	0.68	1.47	0.46	2.82	0.35	0.50	0.35
Participant 31	3.04	0.33	0.68	2.32	0.43	0.42	0.43
Participant 32	2.86	0.35	0.66	1	1.00	0.15	1.00
Participant 33	0.68	1.47	0.46	3.17	0.32	0.54	0.32
Participant 34	0.54	1.85	0.84	4.34	0.23	0.62	0.23
Participant 35	0.59	1.69	0.69	7.21	0.14	0.71	0.14
Participant 36	0.75	1.33	0.33	3.84	0.26	0.59	0.26

Participants	Time to First Fixation on the	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 37	0.56	1.79	0.78	1.74	0.57	0.28	0.57
Participant 38	3.23	0.31	0.70	2.83	0.35	0.50	0.35
Participant 39	1.03	0.97	0.04	1.27	0.79	0.06	0.79
Participant 40	8.18	0.12	0.88	0.94	1.06	0.21	1.06
Average	2.07	1.01	0.60	2.82	0.85	0.77	0.51
STDEV		0.69			2.21		
3*STDEV		2.06			6.62		

Table 5.3 Participants' chi-square results when analysing pneumo-haemothorax image (Figure 4.12 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	Yes	Yes
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	Yes	No	Yes
Participant 4	Yes	Yes	Yes	Yes
Participant 5	Yes	Yes	Yes	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	No	Yes	No	Yes
Participant 9	Yes	Yes	Yes	Yes
Participant 10	Yes	Yes	No	Yes
Participant 11	No	Yes	Yes	Yes
Participant 12	Yes	Yes	Yes	Yes
Participant 13	No	Yes	Yes	Yes
Participant 14	Yes	Yes	No	Yes
Participant 15	No	Yes	No	Yes
Participant 16	Yes	Yes	No	Yes
Participant 17	Yes	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 18	Yes	Yes	No	Yes
Participant 19	No	Yes	No	Yes
Participant 20	Yes	Yes	Yes	Yes
Participant 21	Yes	Yes	No	Yes
Participant 22	Yes	Yes	Yes	Yes
Participant 23	Yes	Yes	Yes	Yes
Participant 24	Yes	Yes	No	Yes
Participant 25	No	Yes	Yes	Yes
Participant 26	Yes	Yes	No	Yes
Participant 27	Yes	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	Yes	Yes	No	Yes
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	Yes	No	Yes
Participant 32	No	Yes	No	Yes
Participant 33	Yes	Yes	No	Yes
Participant 34	Yes	Yes	Yes	Yes
Participant 35	Yes	Yes	Yes	Yes
Participant 36	No	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 37	Yes	Yes	No	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	Yes	No	Yes

Table 5.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumo-haemothorax image

(Figure 4.12 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.57	1.75	0.19	3.26	0.31	0.20	0.31
Participant 2	0.77	1.30	0.26	1.97	0.51	0.00	0.51
Participant 3	0.3	3.33	1.77	3.44	0.29	0.22	0.29
Participant 4	0.54	1.85	0.29	1.65	0.61	0.10	0.61
Participant 5	1.71	0.58	0.97	1.55	0.65	0.14	0.65
Participant 6	1.92	0.52	1.04	0.87	1.15	0.64	1.15
Participant 7	0.43	2.33	0.77	2.72	0.37	0.14	0.37
Participant 8	0.34	2.94	1.38	1.14	0.88	0.37	0.88
Participant 9	0.66	1.52	0.04	2.92	0.34	0.16	0.34
Participant 10	0.45	2.22	0.66	2.25	0.44	0.06	0.44
Participant 11	6.99	0.14	1.42	4.05	0.25	0.26	0.25
Participant 12	0.34	2.94	1.38	0.72	1.39	0.88	
Participant 13	0.62	1.61	0.05	2.56	0.39	0.12	0.39
Participant 14	0.65	1.54	0.02	0.91	1.10	0.59	1.10
Participant 15	0.66	1.52	0.04	1.07	0.93	0.43	0.93
Participant 16	0.83	1.20	0.35	2.85	0.35	0.16	0.35
Participant 17	0.55	1.82	0.26	2.86	0.35	0.16	0.35

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.45	2.22	0.66	2.97	0.34	0.17	0.34
Participant 19	0.43	2.33	0.77	1.25	0.80	0.29	0.80
Participant 20	2.17	0.46	1.10	1.87	0.53	0.03	0.53
Participant 21	1.1	0.91	0.65	2.05	0.49	0.02	0.49
Participant 22	0.55	1.82	0.26	2.17	0.46	0.05	0.46
Participant 23	4.05	0.25	1.31	3.77	0.27	0.24	0.27
Participant 24	0.43	2.33	0.77	3.76	0.27	0.24	0.27
Participant 25	0.57	1.75	0.19	3.46	0.29	0.22	0.29
Participant 26	0.84	1.19	0.37	2.89	0.35	0.16	0.35
Participant 27	0.47	2.13	0.57	1.4	0.71	0.21	0.71
Participant 28	0.48	2.08	0.52	4.29	0.23	0.27	0.23
Participant 29	0.58	1.72	0.16	2.3	0.43	0.07	0.43
Participant 30	0.8	1.25	0.31	3.21	0.31	0.20	0.31
Participant 31	0.78	1.28	0.28	3.26	0.31	0.20	0.31
Participant 32	1.65	0.61	0.95	1.07	0.93	0.43	0.93
Participant 33	3.39	0.29	1.26	4.32	0.23	0.28	0.23
Participant 34	0.47	2.13	0.57	1.53	0.65	0.15	0.65
Participant 35	0.47	2.13	0.57	1.97	0.51	0.00	0.51

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.51	1.96	0.40	1.76	0.57	0.06	0.57
Participant 37	0.6	1.67	0.11	3.68	0.27	0.24	0.27
Participant 38	3.59	0.28	1.28	2.42	0.41	0.09	0.41
Participant 39	0.87	1.15	0.41	2.2	0.45	0.05	0.45
Participant 40	0.75	1.33	0.23	6.62	0.15	0.36	0.15
Average	1.11	1.56	0.62	2.53	0.51	0.22	0.48
STDEV		0.78			0.29		
3*STDEV		2.33			0.87		

Table 5.5 Participants' chi-square results when analysing pneumo-haemothorax image (Figure 4.13 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	No	Yes	Yes
Participant 2	Yes	Yes	Yes	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	Yes	Yes	Yes
Participant 5	No	Yes	Yes	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	No	No	Yes
Participant 9	No	No	No	Yes
Participant 10	Yes	Yes	No	Yes
Participant 11	Yes	Yes	No	Yes
Participant 12	Yes	Yes	Yes	Yes
Participant 13	Yes	Yes	Yes	Yes
Participant 14	No	Yes	Yes	Yes
Participant 15	Yes	Yes	Yes	Yes
Participant 16	No	Yes	No	Yes
Participant 17	No	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 18	No	Yes	Yes	Yes
Participant 19	Yes	Yes	No	Yes
Participant 20	Yes	Yes	No	Yes
Participant 21	Yes	Yes	Yes	Yes
Participant 22	Yes	Yes	Yes	Yes
Participant 23	Yes	Yes	Yes	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	No	Yes
Participant 26	Yes	No	Yes	Yes
Participant 27	Yes	No	No	Yes
Participant 28	Yes	Yes	Yes	Yes
Participant 29	Yes	Yes	No	Yes
Participant 30	Yes	No	Yes	Yes
Participant 31	Yes	No	Yes	Yes
Participant 32	Yes	No	No	Yes
Participant 33	Yes	Yes	No	Yes
Participant 34	Yes	No	No	Yes
Participant 35	Yes	Yes	No	Yes
Participant 36	Yes	Yes	Yes	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 37	Yes	Yes	Yes	Yes
Participant 38	Yes	Yes	Yes	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	Yes	Yes	Yes

Table 5.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumo-haemothorax image

(Figure 4.13 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.73	1.37	2.60	1.37	2.21	0.45	0.66	0.45
Participant 2	4.27	0.23	3.74	0.23	1.56	0.64	0.48	0.64
Participant 3	0.09	11.11	7.14	11.11	1.64	0.61	0.51	0.61
Participant 4	0		3.97		1.49	0.67	0.45	0.67
Participant 5	13.63	0.07	3.90	0.07	0.35	2.86	1.74	2.86
Participant 6	4.26	0.23	3.74	0.23	0.62	1.61	0.50	1.61
Participant 7	0.61	1.64	2.33	1.64	5.94	0.17	0.95	0.17
Participant 8	0		3.97		0.55	1.82	0.70	1.82
Participant 9	3.51	0.28	3.69	0.28	0.51	1.96	0.84	1.96
Participant 10	0.31	3.23	0.75	3.23	2.92	0.34	0.77	0.34
Participant 11	0.06	16.67	12.69	16.67	2.94	0.34	0.78	0.34
Participant 12	0		3.97		0.68	1.47	0.35	1.47
Participant 13	0.75	1.33	2.64	1.33	3.03	0.33	0.79	0.33
Participant 14	0		3.97		1.13	0.88	0.23	0.88
Participant 15	0.48	2.08	1.89	2.08	3.09	0.32	0.79	0.32
Participant 16	2.04	0.49	3.48	0.49	2.59	0.39	0.73	0.39
Participant 17	0.5	2.00	1.97	2.00	0.87	1.15	0.03	1.15

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.26	3.85	0.13	3.85	0.63	1.59	0.47	1.59
Participant 19	0		3.97		0.87	1.15	0.03	1.15
Participant 20	0.51	1.96	2.01	1.96	0.94	1.06	0.05	1.06
Participant 21	0.46	2.17	1.80	2.17	2.53	0.40	0.72	0.40
Participant 22	0		3.97		2.75	0.36	0.75	0.36
Participant 23	4.87	0.21	3.77	0.21	6.49	0.15	0.96	0.15
Participant 24	0		3.97		2.04	0.49	0.63	0.49
Participant 25	0		3.97		0		1.12	
Participant 26	0		3.97		2.56	0.39	0.73	0.39
Participant 27	0.94	1.06	2.91	1.06	0.64	1.56	0.45	1.56
Participant 28	0.02	50.00	46.03		2.92	0.34	0.77	0.34
Participant 29	1.27	0.79	3.18	0.79	2.13	0.47	0.65	0.47
Participant 30	0.47	2.13	1.84	2.13	2.1	0.48	0.64	0.48
Participant 31	0.7	1.43	2.54	1.43	2.3	0.43	0.68	0.43
Participant 32	5.7	0.18	3.80	0.18	0.07	14.29	13.17	
Participant 33	3.91	0.26	3.72	0.26	3.6	0.28	0.84	0.28
Participant 34	2.3	0.43	3.54	0.43	1.16	0.86	0.25	0.86
Participant 35	0		3.97		3.2	0.31	0.80	0.31

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0		3.97		2.32	0.43	0.69	0.43
Participant 37	0		3.97		0.88	1.14	0.02	1.14
Participant 38	0.45	2.22	1.75	2.22	1.88	0.53	0.58	0.53
Participant 39	0.56	1.79	2.19	1.79	1.59	0.63	0.49	0.63
Participant 40	0.5	2.00	1.97	2.00	5.73	0.17	0.94	0.17
Average	1.35	3.97	4.48	2.27	2.04	1.12	0.94	0.77
STDEV		9.68				2.25		
3*STDEV		29.04				6.74		

6. Pleural Effusion

Table 6.1 Participants' chi-square results when analysing pleural effusion image (Figure 4.11 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	Yes	Yes
Participant 2	No	Yes	No	Yes
Participant 3	Yes	Yes	Yes	Yes
Participant 4	Yes	Yes	Yes	Yes
Participant 5	No	No	Yes	Yes
Participant 6	No	Yes	Yes	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	Yes	No	No	Yes
Participant 9	No	Yes	Yes	Yes
Participant 10	No	No	No	Yes
Participant 11	Yes	Yes	Yes	Yes
Participant 12	Yes	Yes	Yes	Yes
Participant 13	Yes	Yes	Yes	Yes
Participant 14	Yes	No	No	Yes
Participant 15	No	Yes	No	Yes
Participant 16	Yes	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 17	No	Yes	Yes	Yes
Participant 18	No	Yes	No	Yes
Participant 19	Yes	Yes	No	Yes
Participant 20	Yes	Yes	No	No
Participant 21	No	No	No	Yes
Participant 22	Yes	Yes	Yes	Yes
Participant 23	Yes	Yes	Yes	Yes
Participant 24	No	Yes	Yes	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	Yes	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	Yes	Yes	Yes
Participant 32	No	No	No	Yes
Participant 33	Yes	Yes	No	Yes
Participant 34	No	Yes	No	Yes
Participant 35	No	No	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 36	No	Yes	No	Yes
Participant 37	No	Yes	Yes	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	No	No	No	Yes
Participant 40	Yes	Yes	No	Yes

Table 6.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pleural effusion image (Figure 4.11 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.64	1.56	0.34	1.56	2.91	0.34	0.45	0.34
Participant 2	1.81	0.55	1.35	0.55	4.39	0.23	0.57	0.23
Participant 3	0.53	1.89	0.02	1.89	2.66	0.38	0.42	0.38
Participant 4	0		1.91		2.63	0.38	0.41	0.38
Participant 5	11.83	0.08	1.82	0.08	0.15	6.67	5.87	
Participant 6	3.53	0.28	1.62	0.28	0.89	1.12	0.33	1.12
Participant 7	0		1.91		3.9	0.26	0.54	0.26
Participant 8	0.65	1.54	0.37	1.54	1.44	0.69	0.10	0.69
Participant 9	0		1.91		0		0.79	
Participant 10	0.46	2.17	0.27	2.17	2.12	0.47	0.32	0.47
Participant 11	0.04	25.00	23.09		3.84	0.26	0.53	0.26
Participant 12	1.15	0.87	1.04	0.87	0.97	1.03	0.24	1.03
Participant 13	3.44	0.29	1.62	0.29	0.67	1.49	0.70	1.49
Participant 14	1	1.00	0.91	1.00	1.16	0.86	0.07	0.86
Participant 15	2.64	0.38	1.53	0.38	2.6	0.38	0.41	0.38
Participant 16	2.17	0.46	1.45	0.46	3.22	0.31	0.48	0.31
Participant 17	0.51	1.96	0.05	1.96	0.56	1.79	0.99	1.79

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.45	2.22	0.32	2.22	0.92	1.09	0.29	1.09
Participant 19	0.55	1.82	0.09	1.82	1.57	0.64	0.16	0.64
Participant 20	0.93	1.08	0.83	1.08	1.57	0.64	0.16	0.64
Participant 21	0		1.91		5.42	0.18	0.61	0.18
Participant 22	0.79	1.27	0.64	1.27	6.1	0.16	0.63	0.16
Participant 23	0.47	2.13	0.22	2.13	1.66	0.60	0.19	0.60
Participant 24	0		1.91		6.48	0.15	0.64	0.15
Participant 25	0		1.91		1.1	0.91	0.11	0.91
Participant 26	0.58	1.72	0.18	1.72	2.35	0.43	0.37	0.43
Participant 27	1.49	0.67	1.24	0.67	0.67	1.49	0.70	1.49
Participant 28	0		1.91		6.19	0.16	0.63	0.16
Participant 29	1.07	0.93	0.97	0.93	3.38	0.30	0.50	0.30
Participant 30	0.58	1.72	0.18	1.72	4.56	0.22	0.58	0.22
Participant 31	5.44	0.18	1.72	0.18	3.07	0.33	0.47	0.33
Participant 32	4.4	0.23	1.68	0.23	0.33	3.03	2.24	3.03
Participant 33	0		1.91		0.6	1.67	0.87	1.67
Participant 34	1.31	0.76	1.14	0.76	2.08	0.48	0.31	0.48
Participant 35	0.62	1.61	0.29	1.61	5.93	0.17	0.63	0.17

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0		1.91		4.82	0.21	0.59	0.21
Participant 37	0.68	1.47	0.44	1.47	3.82	0.26	0.53	0.26
Participant 38	1.58	0.63	1.27	0.63	2.45	0.41	0.39	0.41
Participant 39	0.57	1.75	0.15	1.75	1.8	0.56	0.24	0.56
Participant 40	1.17	0.85	1.05	0.85	4.14	0.24	0.55	0.24
Average	1.33	1.91	1.63	1.14	2.63	0.79	0.64	0.64
STDEV		4.34				1.16		
3*STDEV		13.01				3.47		

Table 6.3 Participants' chi-square results when analysing pleural effusion image (Figure 4.5 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	No	No	Yes
Participant 2	No	Yes	No	Yes
Participant 3	Yes	Yes	No	Yes
Participant 4	No	Yes	No	Yes
Participant 5	Yes	Yes	No	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	Yes	Yes	Yes	Yes
Participant 9	No	Yes	No	Yes
Participant 10	Yes	Yes	No	Yes
Participant 11	Yes	Yes	Yes	Yes
Participant 12	Yes	Yes	Yes	Yes
Participant 13	No	Yes	No	Yes
Participant 14	Yes	Yes	No	Yes
Participant 15	Yes	Yes	Yes	Yes
Participant 16	Yes	Yes	No	Yes
Participant 17	No	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	Yes	Yes	No
Participant 20	Yes	Yes	Yes	Yes
Participant 21	No	No	No	Yes
Participant 22	Yes	Yes	No	Yes
Participant 23	Yes	Yes	Yes	Yes
Participant 24	Yes	Yes	Yes	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	No	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	Yes	Yes	Yes	Yes
Participant 31	No	Yes	Yes	Yes
Participant 32	No	No	No	Yes
Participant 33	Yes	Yes	No	Yes
Participant 34	No	Yes	No	Yes
Participant 35	Yes	Yes	No	Yes
Participant 36	No	No	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 37	No	Yes	No	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	Yes	Yes	No

Table 6.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pleural effusion image (Figure 4.5 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	1.08	0.93	0.60	0.93	2.45	0.41	0.51	0.41
Participant 2	2.87	0.35	1.17	0.35	4.25	0.24	0.68	0.24
Participant 3	0.06	16.67	15.14		2.33	0.43	0.49	0.43
Participant 4	3.22	0.31	1.21	0.31	4.12	0.24	0.67	0.24
Participant 5	0		1.52		0		0.92	
Participant 6	3.11	0.32	1.20	0.32	0.29	3.45	2.53	
Participant 7	1.69	0.59	0.93	0.59	2.45	0.41	0.51	0.41
Participant 8	4.03	0.25	1.27	0.25	1.06	0.94	0.03	0.94
Participant 9	6.76	0.15	1.37	0.15	0.58	1.72	0.81	1.72
Participant 10	0.53	1.89	0.36	1.89	0.47	2.13	1.21	2.13
Participant 11	8.8	0.11	1.41	0.11	3.13	0.32	0.60	0.32
Participant 12	0.47	2.13	0.60	2.13	0.82	1.22	0.30	1.22
Participant 13	0		1.52		0		0.92	
Participant 14	0.79	1.27	0.26	1.27	0.84	1.19	0.27	1.19
Participant 15	3.4	0.29	1.23	0.29	1.87	0.53	0.38	0.53
Participant 16	3.06	0.33	1.20	0.33	1.56	0.64	0.28	0.64
Participant 17	0.66	1.52	0.01	1.52	0.73	1.37	0.45	1.37

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	1.08	0.93	0.60	0.93	0.43	2.33	1.41	2.33
Participant 19	1.71	0.58	0.94	0.58	2.1	0.48	0.44	0.48
Participant 20	0.7	1.43	0.09	1.43	2.42	0.41	0.50	0.41
Participant 21	0.6	1.67	0.14	1.67	2.9	0.34	0.57	0.34
Participant 22	1.62	0.62	0.91	0.62	0.58	1.72	0.81	1.72
Participant 23	3.16	0.32	1.21	0.32	3.17	0.32	0.60	0.32
Participant 24	0.84	1.19	0.33	1.19	1.36	0.74	0.18	0.74
Participant 25	1.36	0.74	0.79	0.74	2.14	0.47	0.45	0.47
Participant 26	0.4	2.50	0.98	2.50	1.11	0.90	0.02	0.90
Participant 27	4.06	0.25	1.28	0.25	0.47	2.13	1.21	2.13
Participant 28	1.23	0.81	0.71	0.81	1.36	0.74	0.18	0.74
Participant 29	12.62	0.08	1.44	0.08	0.98	1.02	0.10	1.02
Participant 30	6.93	0.14	1.38	0.14	1.05	0.95	0.04	0.95
Participant 31	0.1	10.00	8.48	10.00	4.61	0.22	0.70	0.22
Participant 32	0		1.52		0		0.92	
Participant 33	0		1.52		1.24	0.81	0.11	0.81
Participant 34	1.13	0.88	0.64	0.88	1.73	0.58	0.34	0.58
Participant 35	0.46	2.17	0.65	2.17	0.98	1.02	0.10	1.02

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.65	1.54	0.02	1.54	1.53	0.65	0.26	0.65
Participant 37	0.83	1.20	0.32	1.20	3.9	0.26	0.66	0.26
Participant 38	7.28	0.14	1.39	0.14	1.13	0.88	0.03	0.88
Participant 39	3.2	0.31	1.21	0.31	0.67	1.49	0.58	1.49
Participant 40	4.34	0.23	1.29	0.23	4.92	0.20	0.71	0.20
Average	2.37	1.52	1.47	1.09	1.69	0.92	0.56	0.85
STDEV		3.08				0.72		
3*STDEV		9.25				2.16		

Table 6.5 Participants' chi-square results when analysing pleural effusion image (Figure 4.10 in Appendix A)

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	No	Yes	No	Yes
Participant 3	Yes	Yes	No	Yes
Participant 4	No	Yes	Yes	Yes
Participant 5	No	Yes	Yes	Yes
Participant 6	No	Yes	Yes	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	Yes	Yes	No	Yes
Participant 9	No	Yes	No	Yes
Participant 10	No	Yes	Yes	Yes
Participant 11	Yes	Yes	Yes	Yes
Participant 12	No	Yes	Yes	Yes
Participant 13	No	Yes	Yes	Yes
Participant 14	No	Yes	Yes	Yes
Participant 15	No	Yes	No	Yes
Participant 16	Yes	Yes	No	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 17	Yes	Yes	No	Yes
Participant 18	No	Yes	Yes	Yes
Participant 19	Yes	Yes	Yes	Yes
Participant 20	Yes	Yes	No	Yes
Participant 21	No	Yes	No	Yes
Participant 22	Yes	Yes	Yes	Yes
Participant 23	No	Yes	Yes	Yes
Participant 24	No	Yes	No	Yes
Participant 25	No	Yes	Yes	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	Yes	Yes	Yes	Yes
Participant 28	No	Yes	Yes	Yes
Participant 29	No	Yes	Yes	Yes
Participant 30	Yes	Yes	Yes	Yes
Participant 31	Yes	Yes	No	Yes
Participant 32	No	No	No	Yes
Participant 33	Yes	Yes	Yes	Yes
Participant 34	Yes	No	No	Yes
Participant 35	Yes	Yes	Yes	Yes

	Criteria			
Participants	Correct Answer	Compare both lungs	Check costophrenic angles	Looked at the AOI
Participant 36	No	Yes	No	Yes
Participant 37	No	Yes	No	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	No	Yes	Yes	Yes
Participant 40	No	Yes	Yes	Yes

Table 6.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pleural effusion image (Figure 4.10 in Appendix A)

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.45	2.22	0.15	2.22	2.19	0.46	0.34	0.46
Participant 2	0.42	2.38	0.01	2.38	2.79	0.36	0.44	0.36
Participant 3	0.33	3.03	0.66	3.03	1.14	0.88	0.08	0.88
Participant 4	0.59	1.69	0.68	1.69	3.73	0.27	0.53	0.27
Participant 5	0.44	2.27	0.10	2.27	1.93	0.52	0.28	0.52
Participant 6	3.37	0.30	2.08	0.30	0.27	3.70	2.91	
Participant 7	0.47	2.13	0.24	2.13	1.02	0.98	0.18	0.98
Participant 8	0.5	2.00	0.37	2.00	2.29	0.44	0.36	0.44
Participant 9	0.71	1.41	0.96	1.41	2.18	0.46	0.34	0.46
Participant 10	0.03	33.33	30.96		5.02	0.20	0.60	0.20
Participant 11	6.11	0.16	2.21	0.16	2.18	0.46	0.34	0.46
Participant 12	0.49	2.04	0.33	2.04	0.84	1.19	0.39	1.19
Participant 13	1.19	0.84	1.53	0.84	0.71	1.41	0.61	1.41
Participant 14	0.51	1.96	0.41	1.96	2.98	0.34	0.46	0.34
Participant 15	0.61	1.64	0.73	1.64	1.27	0.79	0.01	0.79
Participant 16	3.13	0.32	2.05	0.32	1.32	0.76	0.04	0.76
Participant 17	0.51	1.96	0.41	1.96	1.47	0.68	0.12	0.68

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.42	2.38	0.01	2.38	2.77	0.36	0.44	0.36
Participant 19	1.37	0.73	1.64	0.73	0.45	2.22	1.42	2.22
Participant 20	0.7	1.43	0.94	1.43	0.87	1.15	0.35	1.15
Participant 21	0.55	1.82	0.55	1.82	5.32	0.19	0.61	0.19
Participant 22	0.58	1.72	0.65	1.72	3.74	0.27	0.53	0.27
Participant 23	5.97	0.17	2.20	0.17	5.23	0.19	0.61	0.19
Participant 24	0.44	2.27	0.10	2.27	4.69	0.21	0.58	0.21
Participant 25	0.58	1.72	0.65	1.72	4.72	0.21	0.59	0.21
Participant 26	0.6	1.67	0.71	1.67	0.88	1.14	0.34	1.14
Participant 27	1.7	0.59	1.78	0.59	0.38	2.63	1.83	2.63
Participant 28	0.55	1.82	0.55	1.82	4.54	0.22	0.58	0.22
Participant 29	4.28	0.23	2.14	0.23	1.55	0.65	0.15	0.65
Participant 30	0.41	2.44	0.07	2.44	0.64	1.56	0.76	1.56
Participant 31	0.5	2.00	0.37	2.00	4.44	0.23	0.57	0.23
Participant 32	0.5	2.00	0.37	2.00	0.36	2.78	1.98	2.78
Participant 33	4.44	0.23	2.15	0.23	1.72	0.58	0.22	0.58
Participant 34	0.42	2.38	0.01	2.38	2.2	0.45	0.34	0.45
Participant 35	0.77	1.30	1.07	1.30	0.88	1.14	0.34	1.14

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.47	2.13	0.24	2.13	3.47	0.29	0.51	0.29
Participant 37	0.48	2.08	0.29	2.08	2.66	0.38	0.42	0.38
Participant 38	0.52	1.92	0.45	1.92	2.3	0.43	0.36	0.43
Participant 39	2.03	0.49	1.88	0.49	2.06	0.49	0.31	0.49
Participant 40	0.6	1.67	0.71	1.67	3.57	0.28	0.52	0.28
Average	1.22	2.37	1.59	1.58	2.32	0.80	0.56	0.72
STDEV		5.08				0.79		
3*STDEV		15.24				2.38		

Appendix I – Information letter

INFORMATION LETTER TO RADIOGRAPHER

To whom it may concern

RE: REQUEST FOR FIRST-YEAR AND FOURTH-YEAR RADIOGRAPHY STUDENTS TO CRITIQUE AND SCAN X-RAY IMAGES FOR PATHOLOGIES FOR MASTER OF INFORMATION TECHNOLOGY

The title of my study is: **Utilising eye-tracking to train Radiography students to focus on the correct elements during X-ray image analysis**

I, Tholoana Vero Motaung am a registered Masters student in the department of Information Technology. I hereby request that you critique and find pathology on X-ray images. You will be given six images with different types of pathologies. The first-year radiography students will be provided with preparation material to prepare for a lesson that involves scanning of X-ray images for pathologies and image critique. A lecture on how to critique an X-ray image and how to identify a pathology correctly will be offered to the first-year students. The fourth-year students will be regarded as the experts in the study. All the first-year students registered for the qualification Bachelor of Radiography in Diagnostics will participate in the study. The Head of Department in the Clinical Sciences Department will recruit the participants by sending out an invitation to all the first-year and fourth-year students on blackboard (eThuto). Please note that participation is of free will. You may withdraw at any time, without consequences. Your name will not be mentioned

in the dissertation after the research is completed. Participants' anonymity will be protected as necessary in the study. All information captured on computer will only be accessible by staff participating in a study using passwords and access privileges.

If anything is unclear to you, you may contact the researcher on 071 792 6309 or thulymotaung@gmail.com

I trust that you will consider the above request favourably.

Yours sincerely

TV Motaung



Signature of the researcher



24 August 2020

Date

Appendix J – Informed consent form

INFORMED CONSENT

Radiographer

RE: REQUEST FOR FIRST-YEAR AND FOURTH-YEAR RADIOGRAPHY STUDENTS TO CRITIQUE AND SCAN X-RAY IMAGES FOR PATHOLOGIES FOR MASTER OF INFORMATION TECHNOLOGY

Title: Utilising eye-tracking to train Radiography students to focus on the correct elements during X-ray image analysis

I, _____ (Name and surname) read and understand the information letter concerning the data collection of six chest x-ray images for scanning of pathologies and image critique requested by the researcher. I hereby give consent to collect the data truthfully. My name will not be mentioned in the dissertation after the research is completed and my anonymity will be protected as necessary in the study. All information captured on computer will only be accessible by staff participating in a study using passwords and access privileges.

Signature of the researcher

Signature of radiographer

Date

Appendix K – Ethical clearance



Health Sciences Research Ethics

30-

Nov-2020

Dear **Ms Tholoana Vero Motaung**

Ethics Clearance: **Utilising eye-tracking to train Radiography students to focus on the correct elements during X-ray image analysis**

Principal Investigator: **Ms Tholoana Vero Motaung**

Department: **CUT - Central University of Technology**

APPLICATION APPROVED

Please ensure that you read the whole document

With reference to your application for ethical clearance with the Faculty of Health Sciences, I am pleased to inform you on behalf of the Health Sciences Research Ethics Committee that you have been granted ethical clearance for your project.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2020/1578/2601**

The ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the HSREC for approval to ensure we are kept up to date with your progress and any

ethical implications that may arise. This includes any serious adverse events and/or termination of the study.

A progress report should be submitted within one year of approval, and annually for long term studies. A final report should be submitted at the completion of the study.

The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National

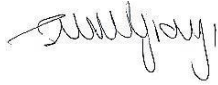
Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical

Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

For any questions or concerns, please feel free to contact HSREC Administration: 051-4017794/5 or email EthicsFHS@ufs.ac.za.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours Sincerely



Dr. SM Le Grange
Chair : Health Sciences Research Ethics Committee

Health Sciences Research Ethics Committee

Office of the Dean: Health Sciences

T: +27 (0)51 401 7795/7794 | E: ethicsfhs@ufs.ac.za

IRB 00011992; REC 230408-011; IORG 0010096; FWA 00027947



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Appendix L – Novices' pre-training results

1. Introduction

This appendix documents the novices' results before the training. It demonstrates the results of the 17 chest X-ray images that were analysed by novice radiographers. The novices were given 17 chest X-ray images to analyse. The gaze behaviour of the novices was recorded during the analysis to ensure that they visited the correct areas and to ensure that they correctly identified the pathology.

The results are provided for each one of the stimuli in two tables. The first table presents the following results:

The participants were required to compare the two lungs by fixating on both lungs and to evaluate the costophrenic angles by visiting the left and right costophrenic angles at least once. They had to gaze at the costophrenic angles as a requirement. They were also required to have visited the AOI at least once (this is the area where the pathology is present). Participants were presented with questionnaires based on the pathology found on each chest X-ray image. They had to identify the pathology present on the images. Each participant's answers were recorded on a paper-based

answering sheet as they analysed the chest X-ray images. The answering sheets are represented in Section 3.3.10 and the full sheet is presented in Appendix B.

The second table recorded the participants' 1-tail t-tests results that were gathered from eye-tracking analysis. Time to First Fixation (in seconds) represents the time it takes for the participants to fixate on the AOI for the first time the stimulus is displayed. Inverse of Time to First Fixation ($V = 1/t$) measures the speed. A higher V value indicates a fast fixation on the pathology. A higher V value for fixation duration indicates that the observer spent a short time fixating on the pathology. Absolute Deviation from Average V ($ABS(V-AVG)$) for Time to First Fixation and Fixation Duration, determines the extent that each participant's performance differs from the average V value. It helps in the identification of outliers. Fixation Duration represents participants' fixation durations within the AOI. The AOI is the area on the chest X-ray where the pathology is present. ABS after outliers were removed column indicates data that was removed because of the extreme values which could affect the results. Fields where outliers were removed are left blank.

This appendix is referenced in Section 3.3.4. The results were referenced in Section 4.2 and the criteria in Section 3.3.6. The chest X-ray images that were analysed are presented in Appendix A and the AOI were referenced in Appendix D.

The data that contained outliers was specifically identified with a red background colour and font, and the 1-tail t-test tables showed that the outliers had been eliminated. Similarly, for the chi-square tables, "yes" responses were shown with a green background, while "no" responses were shown with a red background.

2. Pneumo-haemothorax

Table 2.1 Participants' chi-square results when analysing pneumo-haemothorax image (Figure 3.1 in Appendix A)

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	No	Yes	Yes
Participant 2	No	No	No	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	Yes	No	Yes
Participant 5	Yes	No	No	Yes
Participant 6	No	No	No	Yes
Participant 7	No	No	Yes	Yes
Participant 8	No	No	No	Yes
Participant 9	Yes	No	No	Yes
Participant 10	No	No	Yes	Yes
Participant 11	Yes	No	No	Yes
Participant 12	Yes	No	No	Yes
Participant 13	Yes	No	No	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	No	No	Yes
Participant 16	No	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 17	Yes	No	No	Yes
Participant 18	Yes	No	No	Yes
Participant 19	Yes	No	No	Yes
Participant 20	Yes	No	No	Yes
Participant 21	Yes	No	No	Yes
Participant 22	Yes	No	No	Yes
Participant 23	Yes	No	Yes	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	No	Yes
Participant 26	No	No	No	Yes
Participant 27	Yes	Yes	Yes	Yes
Participant 28	No	No	No	Yes
Participant 29	Yes	Yes	No	Yes
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	Yes	No	Yes
Participant 32	No	No	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	No	No	No	Yes
Participant 35	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 36	No	No	No	Yes
Participant 37	No	No	No	Yes
Participant 38	Yes	Yes	No	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	No	No	Yes
Participant 41	Yes	No	No	Yes

Table 2.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumo-haemothorax image
(Figure 3.1 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.91	1.10	0.13	2.87	0.35	0.54	0.35
Participant 2	0.60	1.67	0.44	1.02	0.98	0.09	0.98
Participant 3	0.51	1.96	0.73	1.23	0.81	0.08	0.81
Participant 4	0.56	1.79	0.56	2.83	0.35	0.54	0.35
Participant 5	1.14	0.88	0.35	1.71	0.58	0.30	0.58
Participant 6	0.93	1.08	0.15	0.78	1.28	0.39	1.28
Participant 7	0.84	1.19	0.04	3.11	0.32	0.57	0.32
Participant 8	0.63	1.59	0.36	1.88	0.53	0.36	0.53
Participant 9	0.59	1.69	0.47	1.75	0.57	0.32	0.57
Participant 10	0.67	1.49	0.27	2.03	0.49	0.40	0.49
Participant 11	2.24	0.45	0.78	0.59	1.69	0.81	1.69
Participant 12	7.05	0.14	1.08	0.43	2.33	1.44	2.33
Participant 13	0.97	1.03	0.20	1.29	0.78	0.11	0.78
Participant 14	0.84	1.19	0.04	0.77	1.30	0.41	1.30
Participant 15	0.49	2.04	0.81	3.50	0.29	0.60	0.29
Participant 16	0.79	1.27	0.04	2.57	0.39	0.50	0.39
Participant 17	0.73	1.37	0.14	2.45	0.41	0.48	0.41

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.74	1.35	0.12	3.13	0.32	0.57	0.32
Participant 19	1.31	0.76	0.46	1.31	0.76	0.13	0.76
Participant 20	0.76	1.32	0.09	3.27	0.31	0.58	0.31
Participant 21	0.68	1.47	0.24	1.48	0.68	0.21	0.68
Participant 22	0.53	1.89	0.66	0.27	3.70	2.81	3.70
Participant 23	0.83	1.20	0.02	2.38	0.42	0.47	0.42
Participant 24	0.77	1.30	0.07	0.91	1.10	0.21	1.10
Participant 25	2.19	0.46	0.77	1.27	0.79	0.10	0.79
Participant 26	0.00		1.23	1.87	0.53	0.35	0.53
Participant 27	0.74	1.35	0.12	3.16	0.32	0.57	0.32
Participant 28	2.07	0.48	0.74	2.40	0.42	0.47	0.42
Participant 29	0.60	1.67	0.44	2.37	0.42	0.47	0.42
Participant 30	1.66	0.60	0.62	0.78	1.28	0.39	1.28
Participant 31	0.74	1.35	0.12	4.77	0.21	0.68	0.21
Participant 32	0.63	1.59	0.36	1.75	0.57	0.32	0.57
Participant 33	1.24	0.81	0.42	5.31	0.19	0.70	0.19
Participant 34	0.00		1.23	0.00		0.89	
Participant 35	0.57	1.75	0.53	7.27	0.14	0.75	0.14

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.59	1.69	0.47	2.19	0.46	0.43	0.46
Participant 37	0.97	1.03	0.20	0.21	4.76	3.87	
Participant 38	0.66	1.52	0.29	2.02	0.50	0.39	0.50
Participant 39	0.65	1.54	0.31	1.14	0.88	0.01	0.88
Participant 40	2.79	0.36	0.87	0.39	2.56	1.67	2.56
Participant 41	2.33	0.43	0.80	1.22	0.82	0.07	0.82
Average	1.09	1.23	0.43	1.99	0.89	0.61	0.79
STDEV		0.49			0.95		
3*STDEV		1.46			2.84		

Table 2.3 Participants' chi-square results when analysing pneumo-haemothorax image (Figure 3.11 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	No	No	No	Yes
Participant 2	Yes	No	No	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	No	No	Yes
Participant 5	Yes	Yes	No	Yes
Participant 6	Yes	Yes	No	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	Yes	No	Yes
Participant 9	Yes	No	No	Yes
Participant 10	No	Yes	No	Yes
Participant 11	Yes	Yes	No	Yes
Participant 12	Yes	No	No	Yes
Participant 13	Yes	No	No	Yes
Participant 14	Yes	Yes	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	No	No	Yes
Participant 17	Yes	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 18	Yes	No	No	Yes
Participant 19	Yes	No	No	Yes
Participant 20	Yes	No	No	No
Participant 21	No	No	No	Yes
Participant 22	No	No	Yes	Yes
Participant 23	Yes	No	No	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	No	Yes
Participant 26	No	Yes	No	Yes
Participant 27	Yes	No	No	Yes
Participant 28	Yes	Yes	No	Yes
Participant 29	No	No	No	Yes
Participant 30	Yes	Yes	Yes	Yes
Participant 31	Yes	No	No	Yes
Participant 32	Yes	Yes	No	Yes
Participant 33	No	No	No	Yes
Participant 34	Yes	Yes	No	Yes
Participant 35	No	Yes	No	Yes
Participant 36	Yes	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 37	No	No	No	Yes
Participant 38	Yes	No	Yes	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	No	No	Yes
Participant 41	Yes	No	No	Yes

Table 2.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumo-haemothorax image (Figure 3.11 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS (V-AVG)	Duration of Fixation on	V=1/t	ABS (V-AVG)	ABS after outliers were
Participant 1	0.73	1.37	0.25	5.39	0.19	0.53	0.19
Participant 2	0.50	2.00	0.88	1.26	0.79	0.08	0.79
Participant 3	4.46	0.22	0.90	2.57	0.39	0.32	0.39
Participant 4	0.58	1.72	0.60	5.17	0.19	0.52	0.19
Participant 5	0.79	1.27	0.15	0.20	5.00	4.29	
Participant 6	1.43	0.70	0.42	0.53	1.89	1.17	1.89
Participant 7	0.48	2.08	0.96	4.85	0.21	0.51	0.21
Participant 8	4.64	0.22	0.90	2.87	0.35	0.36	0.35
Participant 9	0.00		1.12	0.00		0.71	
Participant 10	0.46	2.17	1.05	2.58	0.39	0.32	0.39
Participant 11	1.28	0.78	0.34	1.74	0.57	0.14	0.57
Participant 12	1.38	0.72	0.40	1.18	0.85	0.14	0.85
Participant 13	0.00		1.12	0.00		0.71	
Participant 14	0.86	1.16	0.04	2.64	0.38	0.33	0.38
Participant 15	0.72	1.39	0.27	1.43	0.70	0.01	0.70
Participant 16	1.02	0.98	0.14	3.86	0.26	0.45	0.26
Participant 17	0.72	1.39	0.27	3.15	0.32	0.39	0.32
Participant 18	0.56	1.79	0.67	1.64	0.61	0.10	0.61

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS (V-AVG)	Duration of Fixation on	$V=1/t$	ABS (V-AVG)	ABS after outliers were
Participant 19	0.59	1.69	0.57	2.92	0.34	0.37	0.34
Participant 20	1.77	0.56	0.56	0.93	1.08	0.36	1.08
Participant 21	2.12	0.47	0.65	1.14	0.88	0.16	0.88
Participant 22	2.47	0.40	0.72	3.46	0.29	0.42	0.29
Participant 23	0.00		1.12	0.00		0.71	
Participant 24	1.13	0.88	0.24	1.84	0.54	0.17	0.54
Participant 25	1.28	0.78	0.34	1.19	0.84	0.13	0.84
Participant 26	0.50	2.00	0.88	3.34	0.30	0.41	0.30
Participant 27	1.27	0.79	0.33	1.74	0.57	0.14	0.57
Participant 28	0.75	1.33	0.21	1.52	0.66	0.05	0.66
Participant 29	0.76	1.32	0.20	2.46	0.41	0.31	0.41
Participant 30	0.80	1.25	0.13	1.16	0.86	0.15	0.86
Participant 31	2.59	0.39	0.73	2.93	0.34	0.37	0.34
Participant 32	0.00		1.12	0.00		0.71	
Participant 33	5.02	0.20	0.92	1.47	0.68	0.03	0.68
Participant 34	0.62	1.61	0.49	2.50	0.40	0.31	0.40
Participant 35	0.65	1.54	0.42	2.42	0.41	0.30	0.41
Participant 36	0.50	2.00	0.88	1.06	0.94	0.23	0.94
Participant 37	0.00		1.12	0.00		0.71	
Participant 38	1.63	0.61	0.51	1.09	0.92	0.21	0.92

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS (V-AVG)	Duration of Fixation on	$V=1/t$	ABS (V-AVG)	ABS after outliers were
Participant 39	3.65	0.27	0.85	1.47	0.68	0.03	0.68
Average	1.25	1.12	0.60	1.94	0.71	0.45	0.58
STDEV		0.60			0.82		
3*STDEV		1.80			2.45		

Table 2.5 Participants' chi-square results when analysing pneumo-haemothorax image (Figure 3.16 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	Yes	Yes
Participant 2	Yes	Yes	Yes	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	No	No	Yes
Participant 5	Yes	No	No	Yes
Participant 6	No	No	No	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	Yes	No	Yes
Participant 9	Yes	Yes	Yes	Yes
Participant 10	Yes	No	No	Yes
Participant 11	Yes	Yes	No	Yes
Participant 12	No	No	No	Yes
Participant 13	N/A	N/A	N/A	N/A
Participant 14	Yes	No	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	Yes	No	Yes
Participant 17	Yes	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 18	Yes	Yes	No	No
Participant 19	Yes	No	No	No
Participant 20	Yes	No	No	No
Participant 21	Yes	Yes	No	Yes
Participant 22	No	No	No	Yes
Participant 23	Yes	Yes	No	Yes
Participant 24	Yes	Yes	No	Yes
Participant 25	Yes	No	No	Yes
Participant 26	No	Yes	No	Yes
Participant 27	Yes	No	No	Yes
Participant 28	Yes	No	No	No
Participant 29	Yes	No	No	Yes
Participant 30	Yes	Yes	No	No
Participant 31	Yes	Yes	No	Yes
Participant 32	Yes	No	No	Yes
Participant 33	Yes	Yes	Yes	Yes
Participant 34	Yes	Yes	Yes	Yes
Participant 35	N/A	N/A	N/A	N/A
Participant 36	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 37	No	No	No	No
Participant 38	Yes	Yes	Yes	Yes
Participant 39	Yes	Yes	No	No
Participant 40	No	No	No	No
Participant 41	No	Yes	No	No

Table 2.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumo-haemothorax image

(Figure 3.16 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	3.29	0.30	0.36	4.66	0.21	2.36	0.21
Participant 2	0.00		0.66	0		2.57	
Participant 3	4.41	0.23	0.44	0.57	1.75	0.82	1.75
Participant 4	2.60	0.38	0.28	0.75	1.33	1.24	1.33
Participant 5	0.00		0.66	0		2.57	
Participant 6	8.65	0.12	0.55	0.21	4.76	2.19	4.76
Participant 7	0.00		0.66	0		2.57	
Participant 8	0.00		0.66	0.93	1.08	1.50	1.08
Participant 9	0.00		0.66	0		2.57	
Participant 10	7.30	0.14	0.53	0.1	10.00	7.43	
Participant 11	1.70	0.59	0.08	0.21	4.76	2.19	4.76
Participant 12	2.63	0.38	0.28	0.19	5.26	2.69	5.26
Participant 13	0.00		0.66	0		2.57	
Participant 14	2.42	0.41	0.25	0.31	3.23	0.65	3.23
Participant 15	0.94	1.06	0.40	1.49	0.67	1.90	0.67
Participant 16	1.09	0.92	0.25	0.85	1.18	1.40	1.18
Participant 17	0.96	1.04	0.38	3.25	0.31	2.27	0.31

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.45	2.22	1.56	1.84	0.54	2.03	0.54
Participant 19	3.19	0.31	0.35	0.89	1.12	1.45	1.12
Participant 20	0.00		0.66	0		2.57	
Participant 21	1.60	0.63	0.04	0.53	1.89	0.69	1.89
Participant 22	0.00		0.66	0		2.57	
Participant 23	0.00		0.66	0		2.57	
Participant 24	0.46	2.17	1.51	0.37	2.70	0.13	2.70
Participant 25	2.25	0.44	0.22	0.15	6.67	4.09	6.67
Participant 26	4.99	0.20	0.46	0.28	3.57	1.00	3.57
Participant 27	2.19	0.46	0.21	0.35	2.86	0.28	2.86
Participant 28	0.81	1.23	0.57	1.7	0.59	1.99	0.59
Participant 29	0.00		0.66	0.44	2.27	0.30	2.27
Participant 30	7.69	0.13	0.53	1.55	0.65	1.93	0.65
Participant 31	0.00		0.66	0		2.57	
Participant 32	0.00		0.66	0		2.57	
Participant 33	3.72	0.27	0.40	1.89	0.53	2.05	0.53
Participant 34	2.26	0.44	0.22	0.66	1.52	1.06	1.52
Participant 35	0.00		0.66	0.34	2.94	0.37	2.94

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	1.34	0.75	0.08	1.18	0.85	1.73	0.85
Participant 37	0.63	1.59	0.92	0.87	1.15	1.42	1.15
Participant 38	5.28	0.19	0.47	0.13	7.69	5.12	7.69
Participant 39	0.00		0.66	0		2.57	
Average	1.87	0.66	0.53	0.68	2.57	2.07	2.30
STDEV		0.60			2.45		
3*STDEV		1.79			7.35		

3. Lung Cancer

Table 3.1 Participants' chi-square results when analysing Lung Cancer image (Figure 3.2 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	No	Yes	Yes
Participant 4	Yes	Yes	No	No
Participant 5	Yes	No	No	Yes
Participant 6	Yes	Yes	No	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	No	No	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	Yes	Yes	Yes	No
Participant 11	Yes	No	No	Yes
Participant 12	Yes	No	No	Yes
Participant 13	Yes	No	No	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 17	Yes	No	No	Yes
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	No	No	Yes
Participant 20	Yes	Yes	No	Yes
Participant 21	Yes	No	No	Yes
Participant 22	Yes	Yes	No	Yes
Participant 23	Yes	No	No	Yes
Participant 24	Yes	No	No	No
Participant 25	Yes	Yes	No	Yes
Participant 26	No	No	No	Yes
Participant 27	Yes	Yes	No	Yes
Participant 28	Yes	Yes	No	Yes
Participant 29	No	No	No	Yes
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	No	No	Yes
Participant 32	No	No	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	Yes	Yes	No	Yes
Participant 35	Yes	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 36	Yes	Yes	No	Yes
Participant 37	Yes	No	No	Yes
Participant 38	Yes	No	No	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	No	No	No	Yes
Participant 41	Yes	No	No	Yes

Table 3.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on Lung Cancer image (Figure 3.2 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 1	2.06	0.49	0.69	0.49	0.91	1.10	0.07
Participant 2	2.16	0.46	0.71	0.46	0.31	3.23	2.05
Participant 3	1.64	0.61	0.56	0.61	2.51	0.40	0.77
Participant 4	4.29	0.23	0.94	0.23	0.78	1.28	0.11
Participant 5	1.00	1.00	0.17	1.00	1.52	0.66	0.51
Participant 6	1.65	0.61	0.57	0.61	1.39	0.72	0.45
Participant 7	0.73	1.37	0.20	1.37	4.82	0.21	0.97
Participant 8	0.25	4.00	2.83	4.00	1.29	0.78	0.40
Participant 9	0.19	5.26	4.09		0.73	1.37	0.20
Participant 10	4.96	0.20	0.97	0.20	1.12	0.89	0.28
Participant 11	1.58	0.63	0.54	0.63	0.22	4.55	3.37
Participant 12	3.34	0.30	0.87	0.30	1.97	0.51	0.67
Participant 13	0.00		1.17		0		1.17
Participant 14	0.00		1.17		0		1.17
Participant 15	1.30	0.77	0.40	0.77	0.61	1.64	0.47
Participant 16	3.92	0.26	0.92	0.26	0.21	4.76	3.59
Participant 17	0.98	1.02	0.15	1.02	2.06	0.49	0.69

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)
Participant 18	2.26	0.44	0.73	0.44	1.89	0.53	0.64
Participant 19	2.04	0.49	0.68	0.49	0.28	3.57	2.40
Participant 20	0.81	1.23	0.06	1.23	0.78	1.28	0.11
Participant 21	0.80	1.25	0.08	1.25	0.45	2.22	1.05
Participant 22	0.89	1.12	0.05	1.12	2.21	0.45	0.72
Participant 23	0.91	1.10	0.07	1.10	0.77	1.30	0.13
Participant 24	1.34	0.75	0.43	0.75	0.32	3.13	1.95
Participant 25	0.35	2.86	1.68	2.86	1.18	0.85	0.33
Participant 26	0.87	1.15	0.02	1.15	1.25	0.80	0.37
Participant 27	1.28	0.78	0.39	0.78	8.2	0.12	1.05
Participant 28	1.47	0.68	0.49	0.68	0.88	1.14	0.04
Participant 29	2.04	0.49	0.68	0.49	3.24	0.31	0.86
Participant 30	0.56	1.79	0.61	1.79	2.58	0.39	0.79
Participant 31	0.92	1.09	0.09	1.09	7.95	0.13	1.05
Participant 32	5.34	0.19	0.99	0.19	1.11	0.90	0.27
Participant 33	0.00		1.17		0		1.17
Participant 34	0.51	1.96	0.79	1.96	6.57	0.15	1.02
Participant 35	0.45	2.22	1.05	2.22	6.78	0.15	1.03

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)
Participant 36	1.36	0.74	0.44	0.74	2.18	0.46	0.71
Participant 37	0.91	1.10	0.07	1.10	6.8	0.15	1.03
Participant 38	0.82	1.22	0.05	1.22	1.81	0.55	0.62
Participant 39	0.65	1.54	0.36	1.54	0.59	1.69	0.52
Participant 40	0		1.17		0		1.17
Participant 41	0.49	2.04	0.87	2.04	1.77	0.56	0.61
Average	1.39	1.17	0.73	1.06	1.95	1.17	0.89
STDEV		1.05				1.20	
3*STDEV		3.14				3.61	

Table 3.3 Participants' chi-square results when analysing Lung Cancer image (Figure 3.3 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the Pathology
Participant 1	Yes	No	No	Yes
Participant 2	Yes	No	No	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	No	No	Yes
Participant 5	Yes	No	No	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	No	Yes	Yes
Participant 8	Yes	No	No	Yes
Participant 9	Yes	No	No	Yes
Participant 10	Yes	Yes	No	Yes
Participant 11	Yes	No	Yes	Yes
Participant 12	No	No	No	Yes
Participant 13	Yes	No	Yes	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	No	No	Yes
Participant 16	Yes	No	No	Yes
Participant 17	No	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the Pathology
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	No	No	Yes
Participant 20	Yes	No	Yes	Yes
Participant 21	No	Yes	No	Yes
Participant 22	No	No	No	Yes
Participant 23	Yes	No	Yes	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	Yes	Yes
Participant 26	Yes	No	Yes	Yes
Participant 27	No	No	Yes	Yes
Participant 28	Yes	No	No	Yes
Participant 29	Yes	No	No	Yes
Participant 30	Yes	No	Yes	Yes
Participant 31	No	No	Yes	Yes
Participant 32	Yes	No	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	Yes	No	No	Yes
Participant 35	Yes	No	No	Yes
Participant 36	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the Pathology
Participant 37	No	No	Yes	Yes
Participant 38	No	No	No	Yes
Participant 39	Yes	No	No	Yes
Participant 40	Yes	No	No	Yes
Participant 41	No	No	Yes	Yes

Table 3.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on Lung Cancer image (Figure 3.3 in Appendix A).

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.47	2.13	0.30	4.22	0.24	0.17	0.24
Participant 2	0.25	4.00	2.17	0.73	1.37	0.97	
Participant 3	0.30	3.33	1.50	6.27	0.16	0.24	0.16
Participant 4	0.56	1.79	0.04	1.49	0.67	0.27	0.67
Participant 5	3.72	0.27	1.56	3.74	0.27	0.14	0.27
Participant 6	0.61	1.64	0.19	1.73	0.58	0.17	0.58
Participant 7	0.42	2.38	0.55	9.67	0.10	0.30	0.10
Participant 8	0.56	1.79	0.04	6.03	0.17	0.24	0.17
Participant 9	2.17	0.46	1.37	4.75	0.21	0.19	0.21
Participant 10	0.63	1.59	0.24	4.43	0.23	0.18	0.23
Participant 11	0.47	2.13	0.30	3.72	0.27	0.13	0.27
Participant 12	0.64	1.56	0.27	3.25	0.31	0.10	0.31
Participant 13	0.71	1.41	0.42	2.22	0.45	0.05	0.45
Participant 14	1.59	0.63	1.20	1.45	0.69	0.29	0.69
Participant 15	0.50	2.00	0.17	4.22	0.24	0.17	0.24
Participant 16	2.37	0.42	1.41	2.2	0.45	0.05	0.45
Participant 17	4.70	0.21	1.62	4.87	0.21	0.20	0.21

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.59	1.69	0.13	1.99	0.50	0.10	0.50
Participant 19	0.42	2.38	0.55	4.69	0.21	0.19	0.21
Participant 20	0.30	3.33	1.50	4.12	0.24	0.16	0.24
Participant 21	0.43	2.33	0.50	3.6	0.28	0.13	0.28
Participant 22	0.30	3.33	1.50	4	0.25	0.15	0.25
Participant 23	2.58	0.39	1.44	5.68	0.18	0.23	0.18
Participant 24	0.45	2.22	0.39	1.45	0.69	0.29	0.69
Participant 25	0.45	2.22	0.39	1.29	0.78	0.37	0.78
Participant 26	1.02	0.98	0.85	6.11	0.16	0.24	0.16
Participant 27	0.63	1.59	0.24	2.89	0.35	0.06	0.35
Participant 28	0.47	2.13	0.30	1.79	0.56	0.16	0.56
Participant 29	0.34	2.94	1.11	4.62	0.22	0.19	0.22
Participant 30	0.57	1.75	0.07	4.97	0.20	0.20	0.20
Participant 31	7.06	0.14	1.69	2.83	0.35	0.05	0.35
Participant 32	0.58	1.72	0.10	2.03	0.49	0.09	0.49
Participant 33	1.87	0.53	1.29	2.42	0.41	0.01	0.41
Participant 34	0.34	2.94	1.11	4.89	0.20	0.20	0.20
Participant 35	0.37	2.70	0.87	3.67	0.27	0.13	0.27

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	0.48	2.08	0.25	1.38	0.72	0.32	0.72
Participant 37	0.81	1.23	0.59	4.75	0.21	0.19	0.21
Participant 38	0.55	1.82	0.01	1.18	0.85	0.44	0.85
Participant 39	0.37	2.70	0.87	3.9	0.26	0.15	0.26
Participant 40	0.4	2.50	0.67	0.85	1.18	0.77	1.18
Participant 41	0.64	1.56	0.27	2.71	0.37	0.03	0.37
Average	1.04	1.83	0.73	3.48	0.40	0.21	0.38
STDEV		0.95			0.28		
3*STDEV		2.85			0.84		

Table 3.5 Participants' chi-square results when analysing Lung Cancer image Figure 3.7 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	No	No	Yes
Participant 2	Yes	No	No	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	No	No	Yes
Participant 5	Yes	Yes	No	Yes
Participant 6	Yes	No	Yes	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	Yes	Yes	Yes
Participant 9	Yes	No	No	Yes
Participant 10	Yes	No	No	Yes
Participant 11	Yes	No	No	Yes
Participant 12	Yes	No	Yes	Yes
Participant 13	No	No	No	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	No	Yes	Yes
Participant 16	Yes	No	Yes	Yes
Participant 17	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 18	Yes	No	No	Yes
Participant 19	Yes	No	Yes	Yes
Participant 20	Yes	No	No	Yes
Participant 21	Yes	No	No	Yes
Participant 22	Yes	No	Yes	Yes
Participant 23	No	No	Yes	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	No	No	Yes
Participant 26	Yes	No	No	Yes
Participant 27	Yes	Yes	No	Yes
Participant 28	Yes	No	No	Yes
Participant 29	Yes	No	No	Yes
Participant 30	Yes	No	No	Yes
Participant 31	Yes	Yes	No	Yes
Participant 32	No	No	No	Yes
Participant 33	Yes	No	Yes	Yes
Participant 34	Yes	No	No	Yes
Participant 35	Yes	No	Yes	Yes
Participant 36	No	No	Yes	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 37	Yes	No	Yes	Yes
Participant 38	Yes	No	No	Yes
Participant 39	Yes	No	No	Yes
Participant 40	Yes	No	No	Yes
Participant 41	Yes	No	No	Yes

Table 3.6: Participants' 1-tail t-test results gathered from eye-tracker analysis on Lung Cancer image (Figure 3.7 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.55	1.82	1.26	1.82	3.72	0.27	0.05	0.27
Participant 2	0.45	2.22	0.86	2.22	1.48	0.68	0.35	0.68
Participant 3	0.36	2.78	0.30	2.78	3.99	0.25	0.07	0.25
Participant 4	0.00		3.08		4.66	0.21	0.11	0.21
Participant 5	0.73	1.37	1.71	1.37	2.12	0.47	0.15	0.47
Participant 6	0.00		3.08		2.34	0.43	0.10	0.43
Participant 7	0.00		3.08		2.59	0.39	0.06	0.39
Participant 8	0.34	2.94	0.14	2.94	7.42	0.13	0.19	0.13
Participant 9	0.45	2.22	0.86	2.22	1.08	0.93	0.60	
Participant 10	0.00		3.08		7.62	0.13	0.19	0.13
Participant 11	0.67	1.49	1.59	1.49	6.21	0.16	0.16	0.16
Participant 12	0.00		3.08		4.11	0.24	0.08	0.24
Participant 13	0.00		3.08		1.32	0.76	0.43	0.76
Participant 14	0.88	1.14	1.94	1.14	3.76	0.27	0.06	0.27
Participant 15	0.39	2.56	0.52	2.56	4.87	0.21	0.12	0.21
Participant 16	0.00		3.08		3.02	0.33	0.01	0.33
Participant 17	0.00		3.08		6.5	0.15	0.17	0.15

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.40	2.50	0.58	2.50	3.43	0.29	0.03	0.29
Participant 19	0.45	2.22	0.86	2.22	2.64	0.38	0.06	0.38
Participant 20	0.42	2.38	0.70	2.38	2.1	0.48	0.15	0.48
Participant 21	0.42	2.38	0.70	2.38	7.51	0.13	0.19	0.13
Participant 22	0.50	2.00	1.08	2.00	3.91	0.26	0.07	0.26
Participant 23	0.42	2.38	0.70	2.38	2.72	0.37	0.04	0.37
Participant 24	0.00		3.08		4.44	0.23	0.10	0.23
Participant 25	0.46	2.17	0.91	2.17	2.97	0.34	0.01	0.34
Participant 26	0.04	25.00	21.92		6.98	0.14	0.18	0.14
Participant 27	0.00		3.08		1.69	0.59	0.27	0.59
Participant 28	0.21	4.76	1.68	4.76	5.51	0.18	0.14	0.18
Participant 29	1.49	0.67	2.41	0.67	4.5	0.22	0.10	0.22
Participant 30	0.49	2.04	1.04	2.04	3.07	0.33	0.00	0.33
Participant 31	0.43	2.33	0.75	2.33	5.38	0.19	0.14	0.19
Participant 32	0.36	2.78	0.30	2.78	10.98	0.09	0.23	0.09
Participant 33	0.00		3.08		4.99	0.20	0.12	0.20
Participant 34	0.47	2.13	0.95	2.13	3	0.33	0.01	0.33
Participant 35	0.43	2.33	0.75	2.33	4.11	0.24	0.08	0.24
Participant 36	0.54	1.85	1.23	1.85	2.19	0.46	0.13	0.46

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 37	0.00		3.08		1.61	0.62	0.30	0.62
Participant 38	0.00		3.08		2.55	0.39	0.07	0.39
Participant 39	0.45	2.22	0.86	2.22	7.6	0.13	0.19	0.13
Participant 40	0.4	2.50	0.58	2.50	2.91	0.34	0.02	0.34
Participant 41	0.33	3.03	0.05	3.03	3.27	0.31	0.02	0.31
Average	0.33	3.08	2.13	2.27	4.07	0.32	0.14	0.31
STDEV		4.36				0.18		
3*STDEV		13.07				0.55		

4. Pneumonia

Table 4.1 Participants' chi-square results when analysing pneumonia image (Figure 3.4 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	No	No	Yes
Participant 2	Yes	No	No	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	Yes	Yes	Yes
Participant 5	Yes	No	No	Yes
Participant 6	Yes	No	No	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	Yes	Yes	Yes
Participant 9	Yes	Yes	No	No
Participant 10	Yes	Yes	No	Yes
Participant 11	Yes	No	Yes	No
Participant 12	Yes	No	No	Yes
Participant 13	Yes	Yes	Yes	Yes
Participant 14	Yes	No	No	Yes
Participant 15	No	Yes	No	No
Participant 16	Yes	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 17	Yes	Yes	No	Yes
Participant 18	Yes	Yes	Yes	Yes
Participant 19	Yes	No	No	Yes
Participant 20	Yes	No	Yes	Yes
Participant 21	Yes	No	No	Yes
Participant 22	Yes	No	No	Yes
Participant 23	Yes	No	No	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	No	No
Participant 26	Yes	No	No	Yes
Participant 27	Yes	Yes	Yes	Yes
Participant 28	No	No	Yes	Yes
Participant 29	No	No	No	No
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	No	No	Yes
Participant 32	No	No	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	Yes	Yes	No	No

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 35	No	No	No	No
Participant 36	No	No	No	Yes
Participant 37	Yes	No	Yes	Yes
Participant 38	Yes	No	No	Yes
Participant 39	Yes	Yes	Yes	Yes
Participant 40	Yes	No	No	Yes
Participant 41	No	No	Yes	Yes

Table 4.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumonia image (Figure 3.4 in Appendix A).

	Ellipse							Ellipse 2							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.56	1.79	0.21	1.59	0.63	0.58	0.63	0.25	4.00	1.69	4.00	2.25	0.44	1.28	0.44
Participant 2	2.00	0.50	1.08	2.08	0.48	0.73	0.48	1.35	0.74	1.57	0.74	0.27	3.70	1.98	3.70
Participant 3	0.29	3.45	1.87	3.08	0.32	0.88	0.32	1.09	0.92	1.39	0.92	2.52	0.40	1.33	0.40
Participant 4	0.23	4.35	2.77	3.34	0.30	0.91	0.30	14.67	0.07	2.24	0.07	0.35	2.86	1.13	2.86
Participant 5	5.79	0.17	1.41	1.16	0.86	0.35	0.86	7.00	0.14	2.17	0.14	1.13	0.88	0.84	0.88

	Ellipse							Ellipse 2							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 6	1.39	0.72	0.86	5.07	0.20	1.01	0.20	6.18	0.16	2.15	0.16	1.2	0.83	0.89	0.83
Participant 7	0.61	1.64	0.06	2.54	0.39	0.81	0.39	0.00		2.31		2.55	0.39	1.33	0.39
Participant 8	0.88	1.14	0.44	0.71	1.41	0.20	1.41	0.00		2.31		0		1.72	
Participant 9	1.69	0.59	0.99	1.38	0.72	0.48	0.72	0.47	2.13	0.18	2.13	2.34	0.43	1.30	0.43
Participant 10	0.00		1.58	0		1.21		0.00		2.31		0		1.72	
Participant 11	0.54	1.85	0.27	0.19	5.26	4.06	5.26	5.95	0.17	2.14	0.17	0.38	2.63	0.91	2.63
Participant 12	0.76	1.32	0.26	8.85	0.11	1.09	0.11	11.64	0.09	2.23	0.09	0.4	2.50	0.78	2.50

	Ellipse							Ellipse 2							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 13	0.64	1.56	0.02	0.54	1.85	0.64	1.85	0.00		2.31		0		1.72	
Participant 14	5.63	0.18	1.40	0.58	1.72	0.52	1.72	0.28	3.57	1.26	3.57	0.71	1.41	0.32	1.41
Participant 15	0.30	3.33	1.75	1.4	0.71	0.49	0.71	0.11	9.09	6.78	9.09	1.07	0.93	0.79	0.93
Participant 16	3.97	0.25	1.33	0.22	4.55	3.34	4.55	0.00		2.31		0		1.72	
Participant 17	5.04	0.20	1.38	0.62	1.61	0.41	1.61	1.86	0.54	1.77	0.54	0.32	3.13	1.40	3.13
Participant 18	3.39	0.29	1.28	1.08	0.93	0.28	0.93	4.37	0.23	2.08	0.23	0.8	1.25	0.47	1.25
Participant 19	0.37	2.70	1.12	0.11	9.09	7.88		0.00		2.31		0		1.72	

	Ellipse							Ellipse 2							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 20	0.30	3.33	1.75	1.09	0.92	0.29	0.92	2.60	0.38	1.93	0.38	1.1	0.91	0.82	0.91
Participant 21	0.59	1.69	0.12	1.91	0.52	0.68	0.52	0.00		2.31		0		1.72	
Participant 22	0.42	2.38	0.80	3.47	0.29	0.92	0.29	0.24	4.17	1.86	4.17	4.83	0.21	1.52	0.21
Participant 23	2.27	0.44	1.14	2.38	0.42	0.79	0.42	0.00		2.31		3.35	0.30	1.43	0.30
Participant 24	0.00		1.58	0		1.21		4.75	0.21	2.10	0.21	1.01	0.99	0.73	0.99
Participant 25	0.30	3.33	1.75	1.02	0.98	0.23	0.98	3.32	0.30	2.01	0.30	0.22	4.55	2.82	4.55
Participant 26	0.57	1.75	0.18	0.55	1.82	0.61	1.82	0.24	4.17	1.86	4.17	0.28	3.57	1.85	3.57

	Ellipse							Ellipse 2							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 27	0.44	2.27	0.69	1.29	0.78	0.43	0.78	1.75	0.57	1.74	0.57	2.48	0.40	1.32	0.40
Participant 28	0.59	1.69	0.12	1.67	0.60	0.61	0.60	0.20	5.00	2.69	5.00	1.43	0.70	1.03	0.70
Participant 29	0.67	1.49	0.09	2.84	0.35	0.86	0.35	4.82	0.21	2.10	0.21	1.65	0.61	1.12	0.61
Participant 30	0.53	1.89	0.31	2.82	0.35	0.85	0.35	0.30	3.33	1.02	3.33	2.68	0.37	1.35	0.37
Participant 31	1.12	0.89	0.69	5.03	0.20	1.01	0.20	0.00		2.31		0		1.72	
Participant 32	0.94	1.06	0.52	5.5	0.18	1.03	0.18	0.04	25.00	22.6 9		1.48	0.68	1.05	0.68
Participant 33	0.45	2.22	0.64	2.01	0.50	0.71	0.50	1.07	0.93	1.38	0.93	0.32	3.13	1.40	3.13

	Ellipse							Ellipse 2							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 34	0.43	2.33	0.75	2.28	0.44	0.77	0.44	6.34	0.16	2.15	0.16	0.38	2.63	0.91	2.63
Participant 35	0.47	2.13	0.55	4.37	0.23	0.98	0.23	2.26	0.44	1.87	0.44	0.12	8.33	6.61	
Participant 36	0.73	1.37	0.21	1.87	0.53	0.67	0.53	3.27	0.31	2.01	0.31	0.74	1.35	0.37	1.35
Participant 37	2.91	0.34	1.24	1.54	0.65	0.56	0.65	5.03	0.20	2.11	0.20	0.2	5.00	3.28	5.00
Participant 38	0.43	2.33	0.75	0.4	2.50	1.29	2.50	0.28	3.57	1.26	3.57	0.61	1.64	0.09	1.64
Participant 39	0.70	1.43	0.15	2.3	0.43	0.77	0.43	2.90	0.34	1.97	0.34	1.02	0.98	0.74	0.98
Participant 40	1.46	0.68	0.89	0.41	2.44	1.23	2.44	0.59	1.69	0.62	1.69	9.2	0.11	1.62	0.11

	Ellipse							Ellipse 2							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 41	2.09	0.48	1.10	1.23	0.81	0.39	0.81	0.89	1.12	1.19	1.12	2.44	0.41	1.32	0.41
Average	1.28	1.58	0.88	1.96	1.21	1.04	1.00	2.34	2.31	2.51	1.58	1.26	1.72	1.42	1.52
STDEV		1.06			1.70				4.62				1.78		
3*STDEV		3.19			5.10				13.86				5.33		

Table 4.3 Participants' chi-square results when analysing pneumonia image (Figure 3.6 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	No	No	Yes
Participant 5	Yes	No	No	Yes
Participant 6	Yes	Yes	Yes	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	Yes	No	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	Yes	No	No	Yes
Participant 11	Yes	No	No	Yes
Participant 12	No	No	No	Yes
Participant 13	Yes	No	No	Yes
Participant 14	No	No	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 17	Yes	No	No	Yes
Participant 18	Yes	No	No	Yes
Participant 19	Yes	No	No	Yes
Participant 20	Yes	No	No	Yes
Participant 21	No	No	No	Yes
Participant 22	Yes	Yes	No	Yes
Participant 23	Yes	Yes	No	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	No	Yes
Participant 26	Yes	No	No	Yes
Participant 27	Yes	Yes	No	Yes
Participant 28	Yes	Yes	No	Yes
Participant 29	Yes	Yes	No	Yes
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	Yes	No	Yes
Participant 32	Yes	Yes	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	Yes	Yes	No	Yes
Participant 35	No	No	No	No

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 36	Yes	Yes	No	Yes
Participant 37	No	No	No	Yes
Participant 38	Yes	No	No	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	No	No	Yes
Participant 41	Yes	No	No	Yes

Table 1 Table 4.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumonia image

(Figure 3.6 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	2.63	0.38	2.82	0.38	0.2	5.00	3.47	5.00
Participant 2	0.48	2.08	1.12	2.08	0.42	2.38	0.85	2.38
Participant 3	0.65	1.54	1.66	1.54	2.42	0.41	1.12	0.41
Participant 4	6.61	0.15	3.05	0.15	1.26	0.79	0.74	0.79
Participant 5	0.38	2.63	0.57	2.63	1.59	0.63	0.90	0.63
Participant 6	0.87	1.15	2.05	1.15	3.17	0.32	1.22	0.32
Participant 7	1.32	0.76	2.44	0.76	0.29	3.45	1.92	3.45

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 8	0.42	2.38	0.82	2.38	1.09	0.92	0.61	0.92
Participant 9	2.13	0.47	2.73	0.47	0.52	1.92	0.39	1.92
Participant 10	0.00		3.20		0		1.53	
Participant 11	0.94	1.06	2.14	1.06	1.47	0.68	0.85	0.68
Participant 12	1.04	0.96	2.24	0.96	4.56	0.22	1.31	0.22
Participant 13	0.31	3.23	0.03	3.23	0.88	1.14	0.40	1.14
Participant 14	0.44	2.27	0.93	2.27	0.47	2.13	0.60	2.13
Participant 15	2.14	0.47	2.73	0.47	0.27	3.70	2.17	3.70
Participant 16	0.25	4.00	0.80	4.00	1.2	0.83	0.70	0.83

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 17	0.43	2.33	0.87	2.33	1.5	0.67	0.87	0.67
Participant 18	0.27	3.70	0.50	3.70	2.83	0.35	1.18	0.35
Participant 19	0.00		3.20		0.86	1.16	0.37	1.16
Participant 20	0.64	1.56	1.64	1.56	0.34	2.94	1.41	2.94
Participant 21	1.36	0.74	2.46	0.74	0.86	1.16	0.37	1.16
Participant 22	10.68	0.09	3.11	0.09	1.64	0.61	0.92	0.61
Participant 23	1.71	0.58	2.62	0.58	0.91	1.10	0.43	1.10
Participant 24	0.11	9.09	5.89	9.09	1.69	0.59	0.94	0.59
Participant 25	0.19	5.26	2.06	5.26	1.47	0.68	0.85	0.68

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 26	0.24	4.17	0.97	4.17	0.56	1.79	0.25	1.79
Participant 27	0.00		3.20		0.3	3.33	1.80	3.33
Participant 28	0.25	4.00	0.80	4.00	0.15	6.67	5.13	
Participant 29	1.83	0.55	2.65	0.55	1.67	0.60	0.93	0.60
Participant 30	0.84	1.19	2.01	1.19	0.52	1.92	0.39	1.92
Participant 31	0.85	1.18	2.02	1.18	0.84	1.19	0.34	1.19
Participant 32	0.00		3.20		3.4	0.29	1.24	0.29
Participant 33	6.05	0.17	3.03	0.17	2.74	0.36	1.17	0.36
Participant 34	0.02	50.00	46.80		3.86	0.26	1.27	0.26

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 35	2.49	0.40	2.80	0.40	0.61	1.64	0.11	1.64
Participant 36	1.67	0.60	2.60	0.60	1.48	0.68	0.86	0.68
Participant 37	0.24	4.17	0.97	4.17	0.27	3.70	2.17	3.70
Participant 38	2.28	0.44	2.76	0.44	0.28	3.57	2.04	3.57
Participant 39	0.78	1.28	1.92	1.28	3.72	0.27	1.26	0.27
Participant 40	0.50	2.00	1.20	2.00	1.18	0.85	0.68	0.85
Participant 41	0.73	1.37	1.83	1.37	2.62	0.38	1.15	0.38
Average	1.34	3.20	3.18	1.90	1.37	1.53	1.14	1.40
STDEV		8.12				1.47		

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
3*STDEV		24.35				4.42		

Table 4.5 Participants' chi-square results when analysing pneumonia image (Figure 3.9 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participants 1	Yes	Yes	No	Yes
Participants 2	Yes	Yes	No	Yes
Participants 3	Yes	No	Yes	Yes
Participants 4	No	No	Yes	Yes
Participants 5	Yes	No	No	Yes
Participants 6	Yes	No	No	Yes
Participants 7	Yes	No	Yes	Yes
Participants 8	Yes	No	Yes	Yes
Participants 9	Yes	No	No	Yes
Participants 10	Yes	Yes	No	Yes
Participants 11	Yes	No	No	Yes
Participants 12	Yes	No	No	Yes
Participants 13	Yes	No	No	Yes
Participants 14	Yes	No	No	Yes
Participants 15	Yes	Yes	No	Yes
Participants 16	Yes	No	Yes	Yes
Participants 17	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participants 18	Yes	No	Yes	Yes
Participants 19	Yes	No	Yes	Yes
Participants 20	Yes	Yes	Yes	Yes
Participants 21	No	No	No	No
Participants 22	No	No	Yes	No
Participants 23	Yes	No	No	Yes
Participants 24	Yes	No	No	Yes
Participants 25	Yes	Yes	No	Yes
Participants 26	Yes	No	No	Yes
Participants 27	Yes	No	No	Yes
Participants 28	Yes	No	Yes	Yes
Participants 29	Yes	No	Yes	Yes
Participants 30	Yes	No	Yes	Yes
Participants 31	Yes	No	No	Yes
Participants 32	Yes	No	No	Yes
Participants 33	Yes	No	No	Yes
Participants 34	Yes	No	No	Yes
Participants 35	Yes	No	No	Yes
Participants 36	Yes	No	Yes	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participants 37	Yes	No	Yes	Yes
Participants 38	Yes	No	Yes	Yes
Participants 39	Yes	Yes	No	Yes
Participants 40	Yes	No	No	Yes
Participants 41	Yes	No	No	Yes

Table 4.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumonia image (Figure 3.9 in Appendix A).

	Ellipse							Ellipse 2								Ellipse 3							
Participants	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were			
1	2.04	0.49	1.27	1.57	0.64	0.58	0.64	1.73	0.58	0.14	0.58	1.32	0.76	1.08	0.76	0.74	1.35	0.01	1.35	1.09	0.92	0.09	0.92
2	0.48	2.08	0.33	1.27	0.79	0.43	0.79	1.70	0.59	0.13	0.59	0.29	3.45	1.61	3.45	0.76	1.32	0.02	1.32	0.57	1.75	0.75	1.75
3	4.93	0.20	1.56	0.67	1.49	0.28	1.49	4.70	0.21	0.50	0.21	0.38	2.63	0.79	2.63	0.93	1.08	0.26	1.08	6.07	0.16	0.84	0.16
4	2.54	0.39	1.36	1.83	0.55	0.67	0.55	1.83	0.55	0.17	0.55	0.49	2.04	0.20	2.04	0.63	1.59	0.25	1.59	1.67	0.60	0.41	0.60
5	0.80	1.25	0.51	1.19	0.84	0.38	0.84	0.33	3.03	2.32		0.67	1.49	0.35	1.49	2.32	0.43	0.91	0.43	0.71	1.41	0.40	1.41
6	0.25	4.00	2.24	0.78	1.28	0.06	1.28	3.68	0.27	0.44	0.27	0.17	5.88	4.04		1.01	0.99	0.35	0.99	0.85	1.18	0.17	1.18
7	0.74	1.35	0.41	0.8	1.25	0.03	1.25	1.32	0.76	0.04	0.76	0.91	1.10	0.74	1.10	1.84	0.54	0.80	0.54	3.36	0.30	0.71	0.30
8	0.38	2.63	0.87	1.74	0.57	0.64	0.57	0.96	1.04	0.33	1.04	0.77	1.30	0.54	1.30	1.58	0.63	0.71	0.63	1.5	0.67	0.34	0.67
9	1.04	0.96	0.80	1.13	0.88	0.33	0.88	1.68	0.60	0.12	0.60	0.76	1.32	0.52	1.32	4.08	0.25	1.09	0.25	0.58	1.72	0.72	1.72

	Ellipse							Ellipse 2								Ellipse 3							
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on	V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were
10	0.45	2.22	0.46	1.67	0.60	0.62	0.60	3.16	0.32	0.40	0.32	0.35	2.86	1.02	2.86	1.16	0.86	0.48	0.86	2.37	0.42	0.58	0.42
11	1.04	0.96	0.80	1.42	0.70	0.51	0.70	0.67	1.49	0.78	1.49	1.91	0.52	1.31	0.52	3.1	0.32	1.02	0.32	0.57	1.75	0.75	1.75
12	1.10	0.91	0.85	1.45	0.69	0.53	0.69	1.73	0.58	0.14	0.58	0.83	1.20	0.63	1.20	0.72	1.39	0.05	1.39	1.06	0.94	0.06	0.94
13	0.39	2.56	0.81	1.27	0.79	0.43	0.79	0.61	1.64	0.93	1.64	0.51	1.96	0.12	1.96	0		1.34		0		1.01	
14	0.00		1.76	0		1.22		2.64	0.38	0.34	0.38	0.16	6.25	4.41		12.91	0.08	1.26	0.08	0.65	1.54	0.53	1.54
15	1.82	0.55	1.21	1.79	0.56	0.66	0.56	1.51	0.66	0.05	0.66	0.98	1.02	0.82	1.02	0.53	1.89	0.55	1.89	2.52	0.40	0.61	0.40
16	0.00		1.76	0.99	1.01	0.21	1.01	2.46	0.41	0.31	0.41	0.35	2.86	1.02	2.86	0.99	1.01	0.33	1.01	0.57	1.75	0.75	1.75
17	0.00		1.76	0		1.22		0.00		0.71		0		1.84		0.4	2.50	1.16	2.50	1.87	0.53	0.47	0.53
18	1.80	0.56	1.20	3.36	0.30	0.92	0.30	2.69	0.37	0.34	0.37	1.38	0.72	1.11	0.72	0.36	2.78	1.44	2.78	0.58	1.72	0.72	1.72
19	1.83	0.55	1.21	1.01	0.99	0.23	0.99	6.33	0.16	0.56	0.16	0.31	3.23	1.39	3.23	0.8	1.25	0.09	1.25	3.32	0.30	0.70	0.30

	Ellipse							Ellipse 2								Ellipse 3							
Participants	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were			
20	0.20	5.00	3.24	2.52	0.40	0.82	0.40	3.58	0.28	0.43	0.28	1.4	0.71	1.12	0.71	0.62	1.61	0.27	1.61	1.42	0.70	0.30	0.70
21	0.00		1.76	1.68	0.60	0.62	0.60	1.00	1.00	0.29	1.00	2.09	0.48	1.36	0.48	2.35	0.43	0.91	0.43	2.51	0.40	0.61	0.40
22	0.23	4.35	2.59	0.25	4.00	2.78	4.00	0.85	1.18	0.46	1.18	0.99	1.01	0.83	1.01	4.96	0.20	1.14	0.20	0.51	1.96	0.96	1.96
23	2.91	0.34	1.41	0.86	1.16	0.05	1.16	0.84	1.19	0.48	1.19	1.08	0.93	0.91	0.93	0.54	1.85	0.51	1.85	2.52	0.40	0.61	0.40
24	0.46	2.17	0.42	1.07	0.93	0.28	0.93	1.10	0.91	0.20	0.91	0.47	2.13	0.29	2.13	1.38	0.72	0.61	0.72	2.05	0.49	0.52	0.49
25	6.03	0.17	1.59	0.17	5.88	4.67		0.48	2.08	1.37	2.08	0.82	1.22	0.62	1.22	0.9	1.11	0.23	1.11	0.92	1.09	0.08	1.09
26	0.23	4.35	2.59	1.67	0.60	0.62	0.60	2.52	0.40	0.32	0.40	0.72	1.39	0.45	1.39	0.77	1.30	0.04	1.30	1.27	0.79	0.22	0.79
27	0.36	2.78	1.02	0.63	1.59	0.37	1.59	0.00		0.71		0		1.84		0.68	1.47	0.13	1.47	3.05	0.33	0.68	0.33
28	0.25	4.00	2.24	1.38	0.72	0.49	0.72	5.00	0.20	0.51	0.20	0.37	2.70	0.86	2.70	0.5	2.00	0.66	2.00	1.92	0.52	0.48	0.52
29	5.99	0.17	1.59	0.47	2.13	0.91	2.13	1.30	0.77	0.06	0.77	2.78	0.36	1.48	0.36	4.42	0.23	1.11	0.23	0.22	4.55	3.54	

	Ellipse							Ellipse 2								Ellipse 3							
Participants	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were			
30	1.29	0.78	0.98	1.8	0.56	0.66	0.56	1.08	0.93	0.21	0.93	0.42	2.38	0.54	2.38	0		1.34		1.08	0.93	0.08	0.93
31	0.79	1.27	0.49	4.66	0.21	1.00	0.21	8.70	0.11	0.60	0.11	0.43	2.33	0.49	2.33	0.43	2.33	0.99	2.33	2.04	0.49	0.52	0.49
32	0.24	4.17	2.41	1.79	0.56	0.66	0.56	2.93	0.34	0.37	0.34	1.98	0.51	1.33	0.51	0		1.34		0		1.01	
33	0.00		1.76	0.83	1.20	0.01	1.20	1.70	0.59	0.13	0.59	1.27	0.79	1.05	0.79	0.92	1.09	0.25	1.09	0.93	1.08	0.07	1.08
34	0.26	3.85	2.09	3.02	0.33	0.89	0.33	3.26	0.31	0.41	0.31	2.72	0.37	1.47	0.37	0.68	1.47	0.13	1.47	2.71	0.37	0.64	0.37
35	5.27	0.19	1.57	0.15	6.67	5.45		0.92	1.09	0.37	1.09	0.71	1.41	0.43	1.41	0.43	2.33	0.99	2.33	1.37	0.73	0.28	0.73
36	0.60	1.67	0.09	1.36	0.74	0.48	0.74	2.23	0.45	0.27	0.45	0.61	1.64	0.20	1.64	0.78	1.28	0.06	1.28	2.09	0.48	0.53	0.48
37	4.35	0.23	1.53	1.56	0.64	0.58	0.64	2.07	0.48	0.23	0.48	0.51	1.96	0.12	1.96	0		1.34		3.62	0.28	0.73	0.28
38	2.72	0.37	1.39	2.38	0.42	0.80	0.42	3.50	0.29	0.43	0.29	0.58	1.72	0.11	1.72	0.62	1.61	0.27	1.61	2.21	0.45	0.55	0.45
39	0.25	4.00	2.24	1.8	0.56	0.66	0.56	1.55	0.65	0.07	0.65	0.32	3.13	1.29	3.13	2.62	0.38	0.96	0.38	3.01	0.33	0.67	0.33

	Ellipse							Ellipse 2								Ellipse 3							
Participants	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Time to First Fixation on the pathology V=1/t	ABS(V-AVG)	ABS after outliers were	Duration of Fixation on pathology V=1/t	ABS(V-AVG)	ABS after outliers were			
40	0.78	1.28	0.48	0.41	2.44	1.22	2.44	1.12	0.89	0.18	0.89	1.24	0.81	1.03	0.81	0.32	3.13	1.79	3.13	0.24	4.17	3.16	
41	1.95	0.51	1.25	0.83	1.20	0.01	1.20	10.12	0.10	0.62	0.10	0.32	3.13	1.29	3.13	0.21	4.76	3.42		1.61	0.62	0.38	0.62
Average	1.39	1.76	1.36	1.35	1.22	0.83	0.94	2.33	0.71	0.43	0.65	0.84	1.84	1.04	1.61	1.44	1.34	0.75	1.24	1.64	1.01	0.66	0.82
STDEV		1.53			1.38				0.58				1.34				0.95				0.94		
3*STDEV		4.58			4.13				1.74				4.01				2.86				2.83		

5. Pleural Effusion

Table 5.1 Participants' chi-square results when analysing pleural effusion image (Figure 3.5 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	No	Yes	No	Yes
Participant 2	No	No	No	Yes
Participant 3	Yes	Yes	Yes	Yes
Participant 4	Yes	No	No	Yes
Participant 5	No	No	No	Yes
Participant 6	No	No	No	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	No	No	Yes
Participant 9	Yes	No	Yes	Yes
Participant 10	No	No	No	Yes
Participant 11	No	No	No	Yes
Participant 12	Yes	No	No	Yes
Participant 13	Yes	No	No	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 16	Yes	No	No	Yes
Participant 17	Yes	No	No	Yes
Participant 18	No	Yes	Yes	Yes
Participant 19	Yes	No	No	No
Participant 20	Yes	No	No	Yes
Participant 21	No	No	No	Yes
Participant 22	No	No	No	Yes
Participant 23	No	No	No	No
Participant 24	Yes	No	No	No
Participant 25	No	No	No	Yes
Participant 26	Yes	No	Yes	Yes
Participant 27	Yes	No	Yes	Yes
Participant 28	Yes	Yes	No	Yes
Participant 29	Yes	No	No	Yes
Participant 30	Yes	No	No	Yes
Participant 31	No	No	No	Yes
Participant 32	Yes	No	No	Yes
Participant 33	No	No	No	Yes
Participant 34	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 35	No	No	No	Yes
Participant 36	Yes	Yes	No	Yes
Participant 37	No	No	No	Yes
Participant 38	No	No	No	Yes
Participant 39	Yes	No	No	Yes
Participant 40	Yes	Yes	No	Yes
Participant 41	Yes	No	No	Yes

Table 5.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pleural effusion image (Figure 3.5 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 1	0.81	1.23	0.25	2.61	0.38	0.82
Participant 2	0.53	1.89	0.90	0.48	2.08	0.88
Participant 3	1.30	0.77	0.22	1.33	0.75	0.45
Participant 4	0.00		0.99	1.93	0.52	0.68
Participant 5	4.59	0.22	0.77	0.34	2.94	1.74
Participant 6	1.34	0.75	0.24	0.79	1.27	0.06
Participant 7	0.74	1.35	0.36	2.48	0.40	0.80
Participant 8	2.27	0.44	0.55	0.48	2.08	0.88
Participant 9	7.36	0.14	0.85	0.48	2.08	0.88
Participant 10	0.45	2.22	1.24	3.53	0.28	0.92
Participant 11	1.16	0.86	0.12	3.71	0.27	0.93
Participant 12	0.00		0.99	0		1.20
Participant 13	0.00		0.99	0		1.20
Participant 14	0.77	1.30	0.31	0.83	1.20	0.00
Participant 15	0.81	1.23	0.25	4.26	0.23	0.97
Participant 16	0.81	1.23	0.25	2.37	0.42	0.78
Participant 17	0.63	1.59	0.60	1.78	0.56	0.64

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)
Participant 18	0.49	2.04	1.05	0.61	1.64	0.44
Participant 19	0.53	1.89	0.90	0.58	1.72	0.52
Participant 20	0.00		0.99	0		1.20
Participant 21	0.76	1.32	0.33	1.89	0.53	0.67
Participant 22	3.64	0.27	0.71	0.59	1.69	0.49
Participant 23	3.73	0.27	0.72	0.76	1.32	0.11
Participant 24	2.55	0.39	0.59	0.47	2.13	0.93
Participant 25	4.05	0.25	0.74	0.56	1.79	0.58
Participant 26	1.56	0.64	0.35	2.28	0.44	0.76
Participant 27	0.00		0.99	1.69	0.59	0.61
Participant 28	0.58	1.72	0.74	1.57	0.64	0.56
Participant 29	0.00		0.99	1.7	0.59	0.61
Participant 30	2.11	0.47	0.51	0.38	2.63	1.43
Participant 31	2.12	0.47	0.51	0.7	1.43	0.23
Participant 32	0.00		0.99	0		1.20
Participant 33	0.52	1.92	0.94	1.36	0.74	0.47
Participant 34	0.57	1.75	0.77	0.72	1.39	0.19
Participant 35	3.05	0.33	0.66	0.77	1.30	0.10

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)
Participant 36	0.71	1.41	0.42	1.26	0.79	0.41
Participant 37	1.51	0.66	0.32	1.19	0.84	0.36
Participant 38	4.08	0.25	0.74	0.4	2.50	1.30
Participant 39	0.00		0.99	0		1.20
Participant 40	0.85	1.18	0.19	2.72	0.37	0.83
Participant 41	10.29	0.10	0.89	0.37	2.70	1.50
Average	1.64	0.99	0.66	1.22	1.20	0.75
STDEV		0.65			0.80	
3*STDEV		1.95			2.40	

Table 5.3 Participants' chi-square results when analysing pleural effusion image (Figure 3.10 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	Yes	Yes	Yes	Yes
Participant 3	No	Yes	Yes	Yes
Participant 4	Yes	Yes	No	Yes
Participant 5	Yes	Yes	No	Yes
Participant 6	Yes	Yes	No	Yes
Participant 7	Yes	Yes	No	Yes
Participant 8	Yes	No	No	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	Yes	Yes	No	Yes
Participant 11	No	Yes	No	Yes
Participant 12	Yes	Yes	No	Yes
Participant 13	Yes	Yes	Yes	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	Yes	No	Yes
Participant 17	No	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 18	No	Yes	No	Yes
Participant 19	Yes	Yes	No	No
Participant 20	Yes	Yes	No	No
Participant 21	No	Yes	No	Yes
Participant 22	Yes	No	No	Yes
Participant 23	No	Yes	No	Yes
Participant 24	No	Yes	No	No
Participant 25	Yes	Yes	Yes	Yes
Participant 26	No	Yes	Yes	Yes
Participant 27	Yes	Yes	No	Yes
Participant 28	Yes	Yes	No	Yes
Participant 29	Yes	Yes	No	Yes
Participant 30	No	Yes	No	Yes
Participant 31	Yes	Yes	Yes	Yes
Participant 32	No	Yes	No	Yes
Participant 33	Yes	Yes	No	Yes
Participant 34	No	Yes	No	Yes
Participant 35	Yes	No	No	Yes
Participant 36	No	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 37	No	Yes	No	Yes
Participant 38	No	Yes	Yes	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	Yes	No	Yes
Participant 41	Yes	No	No	Yes

Table 5.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pleural effusion image (Figure 3.10 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.87	1.15	0.38	2.65	0.38	1.97	0.38
Participant 2	0		0.77	0		2.35	
Participant 3	0.54	1.85	1.08	1.17	0.85	1.49	0.85
Participant 4	9.85	0.10	0.67	0.78	1.28	1.07	1.28
Participant 5	3.26	0.31	0.46	0.19	5.26	2.91	5.26
Participant 6	1.16	0.86	0.09	0.47	2.13	0.22	2.13
Participant 7	1.06	0.94	0.18	4.57	0.22	2.13	0.22
Participant 8	7.45	0.13	0.63	0.23	4.35	2.00	4.35
Participant 9	0		0.77	0		2.35	
Participant 10	0.85	1.18	0.41	4.33	0.23	2.12	0.23
Participant 11	0		0.77	0.46	2.17	0.18	2.17
Participant 12	0		0.77	0		2.35	
Participant 13	0		0.77	0		2.35	
Participant 14	0.89	1.12	0.36	0.91	1.10	1.25	1.10
Participant 15	1.81	0.55	0.22	0.17	5.88	3.53	5.88
Participant 16	2.17	0.46	0.31	2.51	0.40	1.95	0.40
Participant 17	2.42	0.41	0.35	0.36	2.78	0.43	2.78

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 18	0.76	1.32	0.55	0.49	2.04	0.31	2.04
Participant 19	0.56	1.79	1.02	1.88	0.53	1.82	0.53
Participant 20	6.37	0.16	0.61	0.98	1.02	1.33	1.02
Participant 21	4.22	0.24	0.53	0.59	1.69	0.65	1.69
Participant 22	0		0.77	0.23	4.35	2.00	4.35
Participant 23	0.74	1.35	0.58	2.52	0.40	1.95	0.40
Participant 24	0		0.77	1.47	0.68	1.67	0.68
Participant 25	2.19	0.46	0.31	0.87	1.15	1.20	1.15
Participant 26	0.51	1.96	1.19	0.22	4.55	2.20	4.55
Participant 27	0.54	1.85	1.08	1.89	0.53	1.82	0.53
Participant 28	6.38	0.16	0.61	0.62	1.61	0.74	1.61
Participant 29	0		0.77	0		2.35	
Participant 30	0		0.77	0.48	2.08	0.27	2.08
Participant 31	2.99	0.33	0.43	0.24	4.17	1.82	4.17
Participant 32	0		0.77	0		2.35	
Participant 33	1.29	0.78	0.01	1.03	0.97	1.38	0.97
Participant 34	1.69	0.59	0.18	0.53	1.89	0.46	1.89
Participant 35	4.74	0.21	0.56	3.42	0.29	2.06	0.29

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 36	1.05	0.95	0.18	1.15	0.87	1.48	0.87
Participant 37	1.06	0.94	0.18	1.98	0.51	1.84	0.51
Participant 38	1.22	0.82	0.05	1.18	0.85	1.50	0.85
Participant 39	4.17	0.24	0.53	1.35	0.74	1.61	0.74
Participant 40	3.13	0.32	0.45	0.07	14.29	11.94	
Participant 41	3.75	0.27	0.50	0.1	10.00	7.65	10.00
Average	1.94	0.77	0.55	1.03	2.35	2.03	2.00
STDEV		0.57			2.94		
3*STDEV		1.71			8.83		

Table 5.5 Participants' chi-square results when analysing pleural effusion image (Figure 3.14 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	No	Yes	No
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	No	No	No
Participant 4	Yes	No	No	No
Participant 5	Yes	No	No	No
Participant 6	Yes	Yes	No	Yes
Participant 7	Yes	No	No	No
Participant 8	Yes	Yes	No	Yes
Participant 9	Yes	No	No	No
Participant 10	Yes	No	Yes	No
Participant 11	Yes	Yes	No	Yes
Participant 12	Yes	No	No	No
Participant 13	Yes	No	No	No
Participant 14	Yes	No	No	No
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	No	No	No
Participant 17	Yes	No	No	No

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 18	No	Yes	No	Yes
Participant 19	Yes	No	Yes	No
Participant 20	Yes	Yes	No	Yes
Participant 21	No	No	No	No
Participant 22	Yes	Yes	Yes	Yes
Participant 23	Yes	No	No	No
Participant 24	Yes	No	Yes	No
Participant 25	Yes	Yes	Yes	Yes
Participant 26	Yes	No	No	No
Participant 27	Yes	No	No	No
Participant 28	Yes	No	No	No
Participant 29	Yes	No	No	No
Participant 30	Yes	Yes	No	Yes
Participant 31	Yes	Yes	No	Yes
Participant 32	No	No	No	No
Participant 33	Yes	No	No	No
Participant 34	Yes	Yes	No	Yes
Participant 35	No	No	No	No
Participant 36	Yes	Yes	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 37	Yes	No	No	No
Participant 38	No	No	No	No
Participant 39	Yes	No	No	No
Participant 40	Yes	No	No	Yes
Participant 41	No	No	No	No

Table 5.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pleural effusion image (Figure 3.14 in Appendix A).

	Ellipse						Ellipse 2					
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 1	3.24	0.31	0.10	0.53	1.89	0.38	4.27	0.23	0.08	0.21	4.76	1.16
Participant 2	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 3	2.63	0.38	0.03	0.38	2.63	0.36	0		0.15	0		3.60
Participant 4	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 5	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 6	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 7	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 8	0.00		0.41	0		2.27	0		0.15	0		3.60

	Ellipse						Ellipse 2					
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 9	8.25	0.12	0.28	1.15	0.87	1.40	0		0.15	0		3.60
Participant 10	1.73	0.58	0.17	0.48	2.08	0.19	0		0.15	0		3.60
Participant 11	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 12	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 13	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 14	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 15	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 16	3.34	0.30	0.11	0.9	1.11	1.16	6.53	0.15	0.00	1.3	0.77	2.83
Participant 17	0.00		0.41	0		2.27	0		0.15	0		3.60

	Ellipse						Ellipse 2					
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 18	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 19	2.31	0.43	0.03	0.52	1.92	0.35	0		0.15	0		3.60
Participant 20	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 21	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 22	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 23	14.72	0.07	0.34	0.24	4.17	1.90	0		0.15	0		3.60
Participant 24	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 25	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 26	0.00		0.41	0		2.27	0		0.15	0		3.60

	Ellipse						Ellipse 2					
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 27	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 28	3.45	0.29	0.12	0.27	3.70	1.43	0		0.15	0		3.60
Participant 29	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 30	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 31	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 32	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 33	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 34	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 35	0.00		0.41	0		2.27	0		0.15	0		3.60

	Ellipse						Ellipse 2					
Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 36	0.00		0.41	0		2.27	0		0.15	0		3.60
Participant 37	0.86	1.16	0.76	0.33	3.03	0.76	0		0.15	0		3.60
Participant 38	2.43	0.41	0.01	0.77	1.30	0.97	0		0.15	0		3.60
Participant 39	0.00		0.41	0		2.27	14.01	0.07	0.08	0.19	5.26	1.67
Participant 40	0		0.41	0		2.27	0		0.15	0		3.60
Participant 41	0		0.41	0		2.27	0		0.15	0		3.60
Average	1.05	0.41	0.35	0.14	2.27	1.93	0.61	0.15	0.15	0.04	3.60	3.47
STDEV		0.30			1.10			0.08			2.46	
3*STDEV		0.91			3.30			0.24			7.39	

6. Pneumothorax

Table 6.1 Participants' chi-square results when analysing pneumothorax image (Figure 3.8 in Appendix A).

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	No	Yes	Yes
Participant 2	Yes	No	Yes	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	Yes	No	Yes
Participant 5	Yes	Yes	No	Yes
Participant 6	Yes	No	Yes	Yes
Participant 7	Yes	No	No	Yes
Participant 8	Yes	Yes	Yes	Yes
Participant 9	Yes	Yes	No	Yes
Participant 10	Yes	No	No	Yes
Participant 11	Yes	No	No	Yes
Participant 12	Yes	No	No	Yes
Participant 13	Yes	No	No	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	No	No	Yes
Participant 16	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 17	Yes	No	No	Yes
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	No	No	Yes
Participant 20	Yes	Yes	No	Yes
Participant 21	Yes	No	No	Yes
Participant 22	Yes	Yes	No	Yes
Participant 23	Yes	No	No	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	No	Yes
Participant 26	Yes	No	No	Yes
Participant 27	Yes	No	No	Yes
Participant 28	Yes	No	No	Yes
Participant 29	Yes	Yes	No	Yes
Participant 30	Yes	Yes	Yes	Yes
Participant 31	Yes	No	No	Yes
Participant 32	Yes	No	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	Yes	Yes	No	Yes
Participant 35	Yes	No	No	Yes
Participant 36	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 37	Yes	No	No	Yes
Participant 38	Yes	No	No	Yes
Participant 39	Yes	Yes	No	Yes
Participant 40	Yes	No	No	Yes
Participant 41	Yes	No	Yes	Yes

Table 6.2 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumothorax image (Figure 3.8 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.59	1.69	0.23	6.57	0.15	0.25	0.15
Participant 2	0.21	4.76	2.84	1.96	0.51	0.11	0.51
Participant 3	0.29	3.45	1.53	6.42	0.16	0.25	0.16
Participant 4	0.50	2.00	0.08	8.26	0.12	0.28	0.12
Participant 5	0.46	2.17	0.25	7.11	0.14	0.26	0.14
Participant 6	1.17	0.85	1.07	5.76	0.17	0.23	0.17
Participant 7	0.48	2.08	0.16	2.74	0.36	0.04	0.36
Participant 8	0.19	5.26	3.34	4.03	0.25	0.16	0.25
Participant 9	0.61	1.64	0.28	2.72	0.37	0.04	0.37
Participant 10	0.56	1.79	0.13	0.9	1.11	0.71	1.11
Participant 11	0.58	1.72	0.20	3.97	0.25	0.15	0.25
Participant 12	0.58	1.72	0.20	3.99	0.25	0.15	0.25
Participant 13	0.67	1.49	0.43	1.41	0.71	0.30	0.71
Participant 14	0.48	2.08	0.16	0.81	1.23	0.83	1.23
Participant 15	0.24	4.17	2.25	1.52	0.66	0.25	0.66
Participant 16	3.63	0.28	1.64	5.45	0.18	0.22	0.18
Participant 17	1.24	0.81	1.11	3.36	0.30	0.11	0.30
Participant 18	1.48	0.68	1.24	4.09	0.24	0.16	0.24

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 19	0.65	1.54	0.38	1.48	0.68	0.27	0.68
Participant 20	0.62	1.61	0.31	3.43	0.29	0.11	0.29
Participant 21	0.64	1.56	0.36	5.76	0.17	0.23	0.17
Participant 22	0.48	2.08	0.16	6.37	0.16	0.25	0.16
Participant 23	0.68	1.47	0.45	2.82	0.35	0.05	0.35
Participant 24	0.22	4.55	2.63	3.59	0.28	0.13	0.28
Participant 25	0.70	1.43	0.49	4.9	0.20	0.20	0.20
Participant 26	0.54	1.85	0.07	6.39	0.16	0.25	0.16
Participant 27	1.37	0.73	1.19	0.67	1.49	1.09	
Participant 28	1.15	0.87	1.05	4.12	0.24	0.16	0.24
Participant 29	0.51	1.96	0.04	3.26	0.31	0.10	0.31
Participant 30	0.50	2.00	0.08	0.75	1.33	0.93	1.33
Participant 31	0.20	5.00	3.08	4.47	0.22	0.18	0.22
Participant 32	0.93	1.08	0.84	7.37	0.14	0.27	0.14
Participant 33	0.76	1.32	0.60	2.51	0.40	0.01	0.40
Participant 34	0.32	3.13	1.20	2.97	0.34	0.07	0.34
Participant 35	1.12	0.89	1.03	3.11	0.32	0.08	0.32
Participant 36	0.87	1.15	0.77	2.57	0.39	0.02	0.39
Participant 37	0.69	1.45	0.47	4.38	0.23	0.18	0.23
Participant 38	1.14	0.88	1.04	2.66	0.38	0.03	0.38

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 39	0.56	1.79	0.13	4.41	0.23	0.18	0.23
Participant 40	0.79	1.27	0.65	1.24	0.81	0.40	0.81
Participant 41	2.06	0.49	1.43	3.38	0.30	0.11	0.30
Average	0.77	1.92	0.87	3.75	0.40	0.24	0.38
STDEV		1.24			0.34		
3*STDEV		3.72			1.02		

Table 6.3 Participants' chi-square results when analysing pneumothorax image (Figure 3.15 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	No	Yes
Participant 2	Yes	Yes	No	Yes
Participant 3	Yes	Yes	No	Yes
Participant 4	Yes	No	No	No
Participant 5	Yes	Yes	No	Yes
Participant 6	Yes	No	No	No
Participant 7	Yes	No	No	No
Participant 8	Yes	No	No	No
Participant 9	Yes	Yes	No	No
Participant 10	Yes	No	No	No
Participant 11	Yes	Yes	No	No
Participant 12	Yes	No	No	No
Participant 13	Yes	No	No	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	No	No	No
Participant 16	Yes	Yes	No	Yes
Participant 17	Yes	No	No	Yes
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	No	Yes	No

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 20	Yes	Yes	No	Yes
Participant 21	No	No	No	Yes
Participant 22	Yes	Yes	No	Yes
Participant 23	Yes	No	No	No
Participant 24	Yes	No	Yes	Yes
Participant 25	Yes	Yes	No	Yes
Participant 26	Yes	No	No	No
Participant 27	Yes	No	No	Yes
Participant 28	Yes	No	No	Yes
Participant 29	Yes	No	No	No
Participant 30	No	No	Yes	Yes
Participant 31	Yes	No	No	Yes
Participant 32	Yes	Yes	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	Yes	Yes	No	Yes
Participant 35	No	No	No	No
Participant 36	Yes	No	Yes	Yes
Participant 37	Yes	No	No	No
Participant 38	Yes	No	No	No
Participant 39	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 40	Yes	No	No	N/A
Participant 41	Yes	No	Yes	N/A

Table 6.4 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumothorax image (Figure 3.15 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)	ABS after outliers were removed
Participant 1	0.01	100.00	92.22		2.79	0.36	0.61	0.36
Participant 2	0.00		7.78		1.13	0.88	0.09	0.88
Participant 3	0.53	1.89	5.90	1.89	3.18	0.31	0.66	0.31
Participant 4	0.00		7.78		4.83	0.21	0.77	0.21
Participant 5	1.49	0.67	7.11	0.67	0.39	2.56	1.59	2.56
Participant 6	0.22	4.55	3.24	4.55	0.43	2.33	1.35	2.33
Participant 7	0.00		7.78		1.51	0.66	0.31	0.66
Participant 8	0.19	5.26	2.52	5.26	3.04	0.33	0.64	0.33
Participant 9	0.00		7.78		1.49	0.67	0.30	0.67
Participant 10	0.00		7.78		0		0.97	
Participant 11	0.09	11.11	3.33	11.11	2.32	0.43	0.54	0.43
Participant 12	3.37	0.30	7.49	0.30	0.82	1.22	0.25	1.22
Participant 13	0.25	4.00	3.78	4.00	4.8	0.21	0.76	0.21
Participant 14	0.00		7.78		0.95	1.05	0.08	1.05
Participant 15	1.99	0.50	7.28	0.50	0.32	3.13	2.15	3.13
Participant 16	0.00		7.78		3.26	0.31	0.67	0.31
Participant 17	6.61	0.15	7.63	0.15	0.35	2.86	1.88	2.86
Participant 18	0.00		7.78		6.24	0.16	0.81	0.16

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 19	0.07	14.29	6.50	14.29	1.34	0.75	0.23	0.75
Participant 20	0.00		7.78		2.66	0.38	0.60	0.38
Participant 21	0.00		7.78		3.22	0.31	0.66	0.31
Participant 22	0.00		7.78		1.86	0.54	0.44	0.54
Participant 23	0.22	4.55	3.24	4.55	3.42	0.29	0.68	0.29
Participant 24	0.00		7.78		1.97	0.51	0.47	0.51
Participant 25	1.38	0.72	7.06	0.72	2.43	0.41	0.56	0.41
Participant 26	0.00		7.78		1.95	0.51	0.46	0.51
Participant 27	0.00		7.78		0.73	1.37	0.40	1.37
Participant 28	0.22	4.55	3.24	4.55	1.36	0.74	0.24	0.74
Participant 29	8.55	0.12	7.67	0.12	0.26	3.85	2.87	
Participant 30	0.75	1.33	6.45	1.33	3.39	0.29	0.68	0.29
Participant 31	1.00	1.00	6.78	1.00	0.63	1.59	0.61	1.59
Participant 32	0.80	1.25	6.53	1.25	1.5	0.67	0.31	0.67
Participant 33	0.00		7.78		1.64	0.61	0.36	0.61
Participant 34	1.24	0.81	6.98	0.81	2.27	0.44	0.53	0.44
Participant 35	0.08	12.50	4.72	12.50	1.38	0.72	0.25	0.72
Participant 36	0.72	1.39	6.40	1.39	1.52	0.66	0.31	0.66
Participant 37	3.10	0.32	7.46	0.32	2.08	0.48	0.49	0.48
Participant 38	0.00		7.78		0.47	2.13	1.15	2.13

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)	ABS after outliers were removed
Participant 39	0.00		7.78		3.6	0.28	0.70	0.28
Participant 40	0.00		7.78		0.58	1.72	0.75	1.72
Participant 41	0.00		7.78		0.5	2.00	1.03	2.00
Average	0.80	7.78	8.82	3.39	1.92	0.97	0.71	0.90
STDEV		21.01				0.91		
3*STDEV		63.03				2.74		

Table 6.5 Participants' chi-square results when analysing pneumothorax image (Figure 3.12 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	No	No	Yes
Participant 2	Yes	No	No	Yes
Participant 3	Yes	No	No	Yes
Participant 4	Yes	Yes	No	Yes
Participant 5	Yes	No	No	Yes
Participant 6	Yes	No	No	Yes
Participant 7	Yes	No	No	No
Participant 8	Yes	No	No	Yes
Participant 9	Yes	No	No	Yes
Participant 10	Yes	Yes	No	Yes
Participant 11	Yes	No	No	Yes
Participant 12	Yes	No	No	Yes
Participant 13	Yes	No	No	Yes
Participant 14	Yes	No	No	Yes
Participant 15	Yes	Yes	No	Yes
Participant 16	Yes	No	No	Yes
Participant 17	Yes	No	No	Yes
Participant 18	Yes	Yes	No	Yes
Participant 19	Yes	No	Yes	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 20	Yes	Yes	No	Yes
Participant 21	No	No	No	Yes
Participant 22	Yes	Yes	No	Yes
Participant 23	Yes	No	No	Yes
Participant 24	Yes	No	No	Yes
Participant 25	Yes	Yes	No	Yes
Participant 26	Yes	No	No	Yes
Participant 27	Yes	No	No	Yes
Participant 28	Yes	No	No	Yes
Participant 29	Yes	No	No	Yes
Participant 30	Yes	No	No	Yes
Participant 31	Yes	No	No	Yes
Participant 32	Yes	Yes	No	Yes
Participant 33	Yes	No	No	Yes
Participant 34	Yes	No	No	Yes
Participant 35	Yes	No	No	No
Participant 36	Yes	No	No	Yes
Participant 37	Yes	No	No	Yes
Participant 38	Yes	No	No	Yes
Participant 39	Yes	No	No	Yes

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 40	Yes	No	No	N/A
Participant 41	Yes	No	Yes	N/A

Table 6.6 - Participants' 1-tail t-test results gathered from eye-tracker analysis on pneumothorax image (Figure 3.12 in Appendix A).

Participants	Time to First Fixation on the pathology	V=1/t	ABS(V-AVG)	Duration of Fixation on pathology	V=1/t	ABS(V-AVG)
Participant 1	0.00		1.73	0		3.50
Participant 2	0.00		1.73	0		3.50
Participant 3	0.00		1.73	0.23	4.35	0.84
Participant 4	0.00		1.73	0.32	3.13	0.38
Participant 5	2.35	0.43	1.30	0.32	3.13	0.38
Participant 6	11.91	0.08	1.64	0.11	9.09	5.59
Participant 7	0.00		1.73	0		3.50
Participant 8	2.03	0.49	1.23	0.29	3.45	0.06
Participant 9	0.08	12.50	10.77	0.37	2.70	0.80
Participant 10	0.00		1.73	0		3.50
Participant 11	4.56	0.22	1.51	2.55	0.39	3.11
Participant 12	4.12	0.24	1.48	0.37	2.70	0.80
Participant 13	3.35	0.30	1.43	0.57	1.75	1.75
Participant 14	0.00		1.73	0		3.50
Participant 15	0.09	11.11	9.38	0.18	5.56	2.05
Participant 16	1.55	0.65	1.08	0.22	4.55	1.04
Participant 17	0.00		1.73	0		3.50
Participant 18	3.66	0.27	1.45	1.72	0.58	2.92

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)
Participant 19	0.00		1.73	0		3.50
Participant 20	0.00		1.73	0		3.50
Participant 21	7.39	0.14	1.59	0.17	5.88	2.38
Participant 22	0.00		1.73	0.23	4.35	0.84
Participant 23	0.00		1.73	0.5	2.00	1.50
Participant 24	0.00		1.73	0		3.50
Participant 25	6.47	0.15	1.57	3.35	0.30	3.21
Participant 26	2.91	0.34	1.38	0.56	1.79	1.72
Participant 27	0.00		1.73	0		3.50
Participant 28	2.80	0.36	1.37	0.21	4.76	1.26
Participant 29	0.00		1.73	0		3.50
Participant 30	4.03	0.25	1.48	0.43	2.33	1.18
Participant 31	0.00		1.73	0		3.50
Participant 32	9.12	0.11	1.62	0.27	3.70	0.20
Participant 33	0.00		1.73	0.35	2.86	0.65
Participant 34	0.00		1.73	0.42	2.38	1.12
Participant 35	0.00		1.73	0		3.50
Participant 36	0.00		1.73	0		3.50
Participant 37	0.00		1.73	0.36	2.78	0.73
Participant 38	0.00		1.73	0.21	4.76	1.26

Participants	Time to First Fixation on the pathology	$V=1/t$	ABS(V-AVG)	Duration of Fixation on pathology	$V=1/t$	ABS(V-AVG)
Participant 39	0.00		1.73	0		3.50
Participant 40	0.00		1.73	0		3.50
Participant 41	0.00		1.73	0.12	8.33	4.83
Average	1.62	1.73	2.04	0.35	3.50	2.36
STDEV		3.94			2.16	
3*STDEV		11.83			6.48	

7. Normal X-ray

Table 7.1 Participants' chi-square results when analysing normal X-ray image (Figure 3.13 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	No	N/A
Participant 2	Yes	No	Yes	N/A
Participant 3	Yes	Yes	Yes	N/A
Participant 4	Yes	Yes	No	N/A
Participant 5	Yes	No	Yes	N/A
Participant 6	Yes	Yes	Yes	N/A
Participant 7	Yes	No	Yes	N/A
Participant 8	Yes	No	No	N/A
Participant 9	Yes	No	No	N/A
Participant 10	Yes	No	Yes	N/A
Participant 11	Yes	No	Yes	N/A
Participant 12	Yes	No	Yes	N/A
Participant 13	Yes	No	No	N/A
Participant 14	Yes	Yes	No	N/A
Participant 15	Yes	No	Yes	N/A
Participant 16	Yes	No	Yes	N/A
Participant 17	Yes	No	Yes	N/A
Participant 18	Yes	Yes	Yes	N/A

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 19	Yes	No	Yes	N/A
Participant 20	Yes	No	Yes	N/A
Participant 21	Yes	No	Yes	N/A
Participant 22	Yes	Yes	Yes	N/A
Participant 23	Yes	No	Yes	N/A
Participant 24	Yes	No	No	N/A
Participant 25	Yes	No	Yes	N/A
Participant 26	Yes	No	Yes	N/A
Participant 27	Yes	No	No	N/A
Participant 28	Yes	Yes	Yes	N/A
Participant 29	Yes	No	Yes	N/A
Participant 30	Yes	No	Yes	N/A
Participant 31	No	No	No	N/A
Participant 32	Yes	No	Yes	N/A
Participant 33	Yes	No	No	N/A
Participant 34	Yes	No	Yes	N/A
Participant 35	No	Yes	No	N/A
Participant 36	Yes	No	No	N/A
Participant 37	Yes	No	No	N/A
Participant 38	Yes	No	Yes	N/A

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 39	Yes	No	Yes	N/A
Participant 40	Yes	No	No	No
Participant 41	Yes	No	No	No

Table 7.2 Participants' chi-square results when analysing normal X-ray image (Figure 3.17 in Appendix A).

Participants	Criteria			
	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 1	Yes	Yes	No	N/A
Participant 2	Yes	Yes	Yes	N/A
Participant 3	Yes	No	No	N/A
Participant 4	No	No	No	N/A
Participant 5	No	No	No	N/A
Participant 6	Yes	Yes	Yes	N/A
Participant 7	Yes	No	Yes	N/A
Participant 8	Yes	No	No	N/A
Participant 9	Yes	Yes	No	N/A
Participant 10	Yes	No	No	N/A
Participant 11	Yes	Yes	Yes	N/A
Participant 12	Yes	No	Yes	N/A
Participant 13	N/A	N/A	N/A	N/A
Participant 14	Yes	No	Yes	N/A
Participant 15	Yes	No	No	N/A
Participant 16	Yes	Yes	Yes	N/A
Participant 17	Yes	No	No	N/A
Participant 18	Yes	No	Yes	N/A
Participant 19	Yes	No	Yes	N/A

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 20	Yes	No	No	N/A
Participant 21	Yes	Yes	Yes	N/A
Participant 22	No	No	Yes	N/A
Participant 23	No	Yes	No	N/A
Participant 24	Yes	No	No	N/A
Participant 25	Yes	No	No	N/A
Participant 26	Yes	Yes	Yes	N/A
Participant 27	Yes	No	Yes	N/A
Participant 28	Yes	No	No	N/A
Participant 29	Yes	No	Yes	N/A
Participant 30	Yes	No	Yes	N/A
Participant 31	Yes	No	Yes	N/A
Participant 32	Yes	No	No	N/A
Participant 33	Yes	Yes	No	N/A
Participant 34	Yes	Yes	No	N/A
Participant 35	N/A	N/A	N/A	N/A
Participant 36	Yes	No	No	N/A
Participant 37	No	No	No	N/A
Participant 38	Yes	No	No	N/A
Participant 39	Yes	No	Yes	N/A

	Criteria			
Participants	Compare both lungs	Check costophrenic angles	Correct answer	Looked at the AOI
Participant 40	Yes	No	Yes	N/A
Participant 41	Yes	Yes	Yes	N/A

Appendix M – Novice pre-training gaze behaviours against novice post-training gaze behaviours

1. Introduction

This appendix compares novices' pre-training gaze behaviours against novice post-training gaze behaviours in various hypotheses using chi-square calculations. The purpose is to see if there is a statistically significant difference between the novices' pre-training and the post-training gaze behaviours.

The data is divided into categories based on the images being analysed, such as Pneumo-haemothorax, Lung Cancer, Pneumonia, Pleural Effusion, Pneumothorax and normal images. Each image includes three criteria: comparing both lungs, identifying pathology correctly and checking the costophrenic angles.

The observed values for each criterion are shown in the tables below, with the total number of “Yes” and “No” feedback for both first-year pre-training and first-year post-training. Additionally, the expected values are calculated under hypothesis “there is no difference between the novices' pre-training and novices' post-training gaze behaviours when analysing the chest X-ray images.” To establish the significance of the results, the p-value and chi-square statistic are presented.

The p-value is used to draw conclusions. The null hypothesis ($H_{0,1}$, $H_{0,2}$ and $H_{0,3}$) is rejected if the p-value is less than 0.05. If the p-value is greater than the significance level, the null hypothesis cannot be rejected, indicating that there is no significant difference between the novices' pre- and post-training gaze behaviours. The conclusions on each criterion (Section 3.3.6) and hypothesis (Section 1.4) are supplied at the end of each section. The comparison between the novice pre-and-post-training gaze behaviours is presented in Section 4.2.2.

2. Lung Cancer

Table 2.2: Chi-square results on lung cancer X-ray image (these results are based on comparison between Table 3.1 in Appendix L and Table 2.1 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	37	4	41
Post-test	14	26	40
	51	30	81
Expected			
Pre-Test	25.8	15.2	41
Post-test	25.2	14.8	40
	51	30	81
p	<0.000		
chisq	26.498		
Conclusion:	The null hypothesis can be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	18	23	41
Post-test	32	8	40
	50	31	81

Expected			
Pre-Test	25.3	15.7	41
Post-test	24.7	15.3	40
	50	31	81
p	0.001		
chisq	11.167		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	2	39	41
Post-test	14	26	40
	16	65	81
Expected			
Pre-Test	8.1	32.9	41
Post-test	7.9	32.1	40
	16	65	81
p	0.001		
chisq	11.589		
Conclusion:	The null hypothesis can be rejected		

Table 2.2: Chi-square results on lung cancer X-ray image (these results are based on comparison between Table 3.5 in Appendix L and Table 2.3 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	37	4	41
Post-test	34	6	40
	71	10	81
Expected			
Pre-Test	35.9	5.1	41
Post-test	35.1	4.9	40
	71	10	81
p	0.473		
chisq	0.514		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	4	37	41
Post-test	9	31	40
	13	68	81
Expected			

Pre-Test	6.6	34.4	41
Post-test	6.4	33.6	40
	13	68	81
p	0.118		
chisq	2.441		
Conclusion:	The null hypothesis cannot be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	12	29	41
Post-test	39	1	40
	51	30	81
Expected			
Pre-Test	25.8	15.2	41
Post-test	25.2	14.8	40
	51	30	81
p	<0.000		
chisq	40.421		
Conclusion:	The null hypothesis can be rejected		

Table 2.3: Chi-square results on lung cancer X-ray image (these results are based on comparison between Table 3.3 in Appendix L and Table 2.5 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	32	9	41
Post-test	38	2	40
	70	11	81
Expected			
Pre-Test	35.4	5.6	41
Post-test	34.6	5.4	40
	70	11	81
p	0.026		
chisq	4.957		
Conclusion:	The null hypothesis can be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	5	36	41
Post-test	12	28	40
	17	64	81
Expected			

Pre-Test	8.6	32.4	41
Post-test	8.4	31.6	40
	17	64	81
p	0.049		
chisq	3.871		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	13	28	41
Post-test	35	5	40
	48	33	81
Expected			
Pre-Test	24.3	16.7	41
Post-test	23.7	16.3	40
	48	33	81
p	<0.000		
chisq	26.105		
Conclusion:	The null hypothesis can be rejected		

3. Pneumonia

Table 3.3: Chi-square results on pneumonia X-ray image (these results are based on comparison between Table 4.1 in Appendix L and Table 3.1 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	34	7	41
Post-test	38	2	40
	72	9	81
Expected			
Pre-Test	36.4	4.6	41
Post-test	35.6	4.4	40
	72	9	81
p	0.084		
chisq	2.988		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	14	27	41
Post-test	28	12	40
	42	39	81

Expected			
Pre-Test	21.3	19.7	41
Post-test	20.7	19.3	40
	42	39	81
p	0.001		
chisq	10.425		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	11	30	41
Post-test	8	32	40
	19	62	81
Expected			
Pre-Test	9.6	31.4	41
Post-test	9.4	30.6	40
	19	62	81
p	0.468		
chisq	0.526		
Conclusion:	The null hypothesis cannot be rejected		

Table 3.2: Chi-square results on pneumonia X-ray image (these results are based on comparison between Table 4.3 in Appendix L and Table 3.3 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	36	5	41
Post-test	39	1	40
	75	6	81
Expected			
Pre-Test	38	3	41
Post-test	37	3	40
	75	6	81
p	0.096		
chisq	2.775		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	18	23	41
Post-test	18	22	40
	36	45	81
Expected			

Pre-Test	18.2	22.8	41
Post-test	17.8	22.2	40
	36	45	81
p	0.921		
chisq	0.009		
Conclusion:	The null hypothesis cannot be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	1	40	41
Post-test	5	35	40
	6	75	81
Expected			
Pre-Test	3	38	41
Post-test	3	37	40
	6	75	81
p	0.084		
chisq	2.988		
Conclusion:	The null hypothesis cannot be rejected		

Table 3.3: Chi-square results on pneumonia X-ray image (these results are based on comparison between Table 4.5 in Appendix L and Table 3.5 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	38	3	41
Post-test	39	1	40
	77	4	81
Expected			
Pre-Test	39	2	41
Post-test	38	2	40
	77	4	81
p	0.317		
chisq	1.008		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	7	34	41
Post-test	27	13	40
	34	47	81
Expected			

Pre-Test	17.2	23.8	41
Post-test	16.8	23.2	40
	34	47	81
p	<0.000		
chisq	21.139		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	15	26	41
Post-test	21	19	40
	36	45	81
Expected			
Pre-Test	18.2	22.8	41
Post-test	17.8	22.2	40
	36	45	81
p	0.150		
chisq	2.077		
Conclusion:	The null hypothesis cannot be rejected		

4. Normal

Table 4.4: Chi-square results on normal X-ray image (these results are based on comparison between Table 7.1 in Appendix L and Table 4.1 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	39	2	41
Post-test	39	1	40
	78	3	81
Expected			
Pre-Test	39.5	1.5	41
Post-test	38.5	1.5	40
	78	3	81
p	0.571		
chisq	0.321		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	9	32	41
Post-test	26	14	40
	35	46	81

Expected			
Pre-Test	17.7	23.3	41
Post-test	17.3	22.7	40
	35	46	81
p	<0.000		
chisq	15.291		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	26	15	41
Post-test	18	22	40
	44	37	81
Expected			
Pre-Test	22.3	18.7	41
Post-test	21.7	18.3	40
	44	37	81
p	0.096		
chisq	2.767		
Conclusion:	The null hypothesis cannot be rejected		

Table 4.2: Chi-square results on normal X-ray image (these results are based on comparison between Table 7.2 in Appendix L and Table 4.2 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	34	5	39
Post-test	40	0	40
	74	5	79
Expected			
Pre-Test	36.5	2.5	39
Post-test	37.5	2.5	40
	74	5	79
p	0.019		
chisq	5.475		
Conclusion:	The null hypothesis can be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	12	27	39
Post-test	29	11	40
	41	38	79
Expected			

Pre-Test	20.2	18.8	39
Post-test	20.8	19.2	40
	41	38	79
p	0.000		
chisq	13.775		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	19	20	39
Post-test	17	23	40
	36	43	79
Expected			
Pre-Test	17.78	21.2	39
Post-test	18.2	21.8	40
	36	43	79
p	0.579		
chisq	0.308		
Conclusion:	The null hypothesis cannot be rejected		

5. Pneumo-haemothorax

Table 5.5: Chi-square results on Pneumo-haemothorax X-ray image (these results are based on comparison between Table 2.3 in Appendix L and Table 5.1 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	32	9	41
Post-test	37	3	40
	69	12	81
Expected			
Pre-Test	34.9	6.1	41
Post-test	34.1	5.9	40
	69	12	81
p	0.067		
chisq	3.350		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	17	24	41
Post-test	23	17	40
	40	41	81

Expected			
Pre-Test	20.2	20.8	41
Post-test	19.8	20.2	40
	40	41	81
p	0.149		
chisq	2.083		
Conclusion:	The null hypothesis cannot be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	3	38	41
Post-test	12	28	40
	15	66	81
Expected			
Pre-Test	7.6	33.4	41
Post-test	7.4	32.6	40
	15	66	81
p	0.009		
chisq	6.904		
Conclusion:	The null hypothesis can be rejected		

Table 5.2: Chi-square results on pneumo-haemothorax X-ray image (these results are based on comparison between Table 2.5 in Appendix L and Table 5.5 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	32	7	39
Post-test	28	12	40
	60	19	79
Expected			
Pre-Test	29.6	9.4	39
Post-test	30.4	9.6	40
	60	19	79
p	0.210		
chisq	1.570		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	20	19	39
Post-test	21	19	40
	41	38	79
Expected			

Pre-Test	20.2	18.8	39
Post-test	20.8	19.2	40
	41	38	79
p	0.914		
chisq	0.011		
Conclusion:	The null hypothesis cannot be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	6	33	39
Post-test	34	6	40
	40	39	79
Expected			
Pre-Test	19.7	19.3	39
Post-test	20.3	19.7	40
	40	39	79
p	<0.000		
chisq	38.286		
Conclusion:	The null hypothesis can be rejected		

Table 5.3: Chi-square results on Pneumo-haemothorax X-ray image (these results are based on comparison between Table 2.1 in Appendix L and Table 4.12 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	29	12	41
Post-test	40	0	40
	69	12	81
Expected			
Pre-Test	34.9	6.0	41
Post-test	34.0	5.9	40
	69	12	81
p	0.000		
chisq	13.743		
Conclusion:	The null hypothesis can be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	8	33	41
Post-test	16	24	40
	24	57	81
Expected			

Pre-Test	12.1	28.9	41
Post-test	11.9	28.1	40
	24	57	81
P	0.043		
Chisq	4.076		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	5	36	41
Post-test	31	9	40
	36	45	81
Expected			
Pre-Test	18.2	22.8	41
Post-test	17.8	22.2	40
	36	45	81
p	<0.000		
chisq	34.971		
Conclusion:	The null hypothesis can be rejected		

6. Pleural Effusion

Table 6.6: Chi-square results on pleural effusion X-ray image (these results are based on comparison between Table 5.1 in Appendix L and Table 6.1 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	25	16	41
Post-test	32	8	40
	57	24	81
Expected			
Pre-Test	28.9	12.1	41
Post-test	28.1	11.9	40
	57	24	81
p	0.061		
chisq	3.515		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	6	35	41
Post-test	20	20	40
	26	55	81

Expected			
Pre-Test	13.2	27.8	41
Post-test	12.8	27.2	40
	26	55	81
p	0.001		
chisq	11.619		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	5	36	41
Post-test	21	19	40
	26	55	81
Expected			
Pre-Test	13.2	27.8	41
Post-test	12.8	27.2	40
	26	55	81
p	0.000		
chisq	15.091		
Conclusion:	The null hypothesis can be rejected		

Table 6.2: Chi-square results on pleural effusion X-ray image (these results are based on comparison between Table 5.3 in Appendix L and Table 6.3 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	27	14	41
Post-test	36	4	40
	63	18	81
Expected			
Pre-Test	31.9	9.1	41
Post-test	31.1	8.9	40
	63	18	81
p	0.009		
chisq	6.830		
Conclusion:	The null hypothesis can be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	36	5	41
Post-test	17	23	40
	53	28	81
Expected			

Pre-Test	26.8	14.2	41
Post-test	26.2	13.8	40
	53	28	81
p	<0.000		
chisq	18.373		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	7	34	41
Post-test	25	15	40
	32	49	81
Expected			
Pre-Test	16.2	24.8	41
Post-test	15.8	24.2	40
	32	49	81
p	<0.000		
chisq	17.483		
Conclusion:	The null hypothesis can be rejected		

Table 6.3: Chi-square results on pleural effusion X-ray image (these results are based on comparison between Table 5.5 in Appendix L and Table 6.5 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	35	6	41
Post-test	38	2	40
	73	8	81
Expected			
Pre-Test	37	4	41
Post-test	36	4	40
	73	8	81
p	0.146		
chisq	2.111		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	13	28	41
Post-test	22	18	40
	35	46	81
Expected			

Pre-Test	17.7	23.3	41
Post-test	17.3	22.7	40
	35	46	81
p	0.034		
chisq	4.477		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	6	35	41
Post-test	17	23	40
	23	58	81
Expected			
Pre-Test	11.6	29.4	41
Post-test	11.4	28.6	40
	23	58	81
p	0.005		
chisq	7.732		
Conclusion:	The null hypothesis can be rejected		

7. Pneumothorax

Table 7.7: Chi-square results on pneumothorax X-ray image (these results are based on comparison between Table 6.1 in Appendix L and Table 7.1 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	41	0	41
Post-test	26	14	40
	67	14	81
Expected			
Pre-Test	33.9	7.1	41
Post-test	33.1	6.9	40
	67	14	81
p	<0.000		
chisq	17.349		
Conclusion:	The null hypothesis can be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	12	29	41
Post-test	11	29	40
	23	58	81

Expected			
Pre-Test	11.642	29.358	41
Post-test	11.358	28.642	40
	23	58	81
p	0.860		
chisq	0.031		
Conclusion:	The null hypothesis cannot be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	6	35	41
Post-test	32	8	40
	38	43	81
Expected			
Pre-Test	19.2	21.8	41
Post-test	18.8	21.2	40
	38	43	81
p	<0.000		
chisq	34.736		
Conclusion:	The null hypothesis can be rejected		

Table 7.2: Chi-square results on pneumothorax X-ray image (these results are based on comparison between Table 6.5 in Appendix L and Table 7.3 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	40	1	41
Post-test	39	1	40
	79	2	81
Expected			
Pre-Test	40	1	41
Post-test	39	1	40
	79	2	81
p	0.986		
chisq	0.000		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	8	33	41
Post-test	21	19	40
	29	52	81
Expected			

Pre-Test	14.7	26.3	41
Post-test	14.3	25.7	40
	29	52	81
p	0.002		
chisq	9.586		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	2	39	41
Post-test	20	20	40
	22	59	81
Expected			
Pre-Test	11.1	29.9	41
Post-test	10.9	29.1	40
	22	59	81
p	<0.000		
chisq	20.837		
Conclusion:	The null hypothesis can be rejected		

Table 7.3: Chi-square results on pneumothorax X-ray image (these results are based on comparison between Table 6.3 in Appendix L and Table 7.5 in Appendix H)

Compare both lungs			
Hypothesis:	There is no difference in the ability of first-year students to compare the two lungs in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	38	3	41
Post-test	39	1	40
	77	4	81
Expected			
Pre-Test	39	2	41
Post-test	38	2	40
	77	4	81
p	0.317		
chisq	1.001		
Conclusion:	The null hypothesis cannot be rejected		
Check costophrenic angles			
Hypothesis:	There is no difference in the ability of first-year students to check costophrenic angles in a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	13	28	41
Post-test	27	13	40
	40	41	81
Expected			

Pre-Test	20.2	20.8	41
Post-test	19.8	20.2	40
	40	41	81
p	0.001		
chisq	10.377		
Conclusion:	The null hypothesis can be rejected		
Correct answer			
Hypothesis:	There is no difference in the ability of first-year students to identify a pathology on a chest X-ray image before and after training.		
Observed	Yes	No	
Pre-Test	5	36	41
Post-test	12	28	40
	17	64	81
Expected			
Pre-Test	8.6	32.4	41
Post-test	8.4	31.6	40
	17	64	81
p	0.049		
chisq	3.871		
Conclusion:	The null hypothesis can be rejected		

Appendix N – Novice pre-training gaze behaviours against novice post-training gaze behaviours (t-test calculations)

1. Introduction

This appendix presents the 1-tail t-test results comparing novice pre-training gaze behaviours against novice post training gaze behaviours. Pneumo-haemothorax, lung cancer, pneumonia, pleural effusion and pneumothorax were among the pathologies analysed. The tables below demonstrate the Time to First Fixation and the Duration of Fixation on the pathology for first-year students before training and first-year students after training for each pathology.

The tables present the p-value for 1-tail t-test as well as the conclusions at the end of each table. The p-value is used to draw conclusions. The null hypothesis ($H_{0,4}$ and $H_{0,5}$) is rejected if the p-value is less than 0.05. If the p-value is greater than the significance level, the null hypothesis cannot be rejected, indicating that there is no significant difference between the novices' pre- and post-training gaze behaviours. These results are summarised in Appendix Q and presented in Section 4.2.2.

2. Lung Cancer

Table 2.8: Time to First Fixation on lung cancer image (These results are based on a comparison between Table 3.2 in Appendix L and Table 2.2 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.958	1.068
Variance	0.772	0.650
Observations	36	35
Pooled Variance	0.712	
Hypothesized Mean		
Difference	0	
df	69	
t Stat	-0.553	
P(T<=t) 1-tail	0.291	
t Critical 1-tail	1.667	
P(T<=t) two-tail	0.582	
t Critical two-tail	1.995	
Conclusion: P>.05 H0 Cannot be rejected		

Table 2.2: Duration of Fixation on lung cancer image (These results are based on a comparison between Table 3.2 in Appendix L and Table 2.2 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.777	1.159
Variance	0.692	1.482
Observations	35	36
Pooled Variance	1.093	
Hypothesized Mean		
Difference	0	
df	69	
t Stat	-1.543	
P(T<=t) 1-tail	0.064	
t Critical 1-tail	1.667	
P(T<=t) two-tail	0.127	
t Critical two-tail	1.995	
Conclusion: P>.05 H0 Cannot be rejected		

Table 2.3: Time to First Fixation on lung cancer image (These results are based on a comparison between Table 3.4 in Appendix L and Table 2.4 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	1.853	1.824
Variance	1.001	0.922
Observations	40	40
Pooled Variance	0.962	
Hypothesized Mean		
Difference	0	
df	78	
t Stat	0.131	
P(T<=t) 1-tail	0.448	
t Critical 1-tail	1.665	
P(T<=t) two-tail	0.896	
t Critical two-tail	1.991	
Conclusion: P>.05 H0 Cannot be rejected		

Table 2.4: Duration of Fixation on lung cancer image (These results are based on a comparison between Table 3.4 in Appendix L and Table 2.4 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.396	0.383
Variance	0.029	0.056
Observations	39	39
Pooled Variance	0.043	
Hypothesized Mean		
Difference	0	
df	76	
t Stat	0.277	
P(T<=t) 1-tail	0.391	
t Critical 1-tail	1.665	
P(T<=t) two-tail	0.782	
t Critical two-tail	1.992	
Conclusion: P>.05 H0 Cannot be rejected		

Table 2.5: Time to First Fixation on lung cancer image (These results are based on a comparison between Table 3.6 in Appendix L and Table 2.6 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	1.842	2.256
Variance	0.630	0.548
Observations	40	26
Pooled Variance	0.598	
Hypothesized Mean		
Difference	0	
df	64	
t Stat	-2.124	
P(T<=t) 1-tail	0.018	
t Critical 1-tail	1.667	
P(T<=t) two-tail	0.038	
t Critical two-tail	1.998	
Conclusion: P<.05 H0 can be rejected		

Table 2.6: Duration of Fixation on lung cancer image (These results are based on a comparison between Table 3.6 in Appendix L and Table 2.6 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.565	0.310
Variance	0.103	0.025
Observations	39	39
Pooled Variance	0.064	
Hypothesized Mean		
Difference	0	
df	76	
t Stat	4.435	
P(T<=t) 1-tail	<0.000	
t Critical 1-tail	1.665	
P(T<=t) two-tail	<0.000	
t Critical two-tail	1.992	
Conclusion: P<.05 H0 can be rejected		

3. Pneumonia

Table 3.9: Time to First Fixation on pneumonia image (Left) (These results are based on a comparison between Table 4.2 in Appendix L and Table 3.2 in Appendix H)

Left

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	2.091	1.533
Variance	3.744	1.075
Observations	32	38
Pooled Variance	2.296	
Hypothesized Mean		
Difference	0	
df	68	
t Stat	1.538	
P(T<=t) 1-tail	0.064	
t Critical 1-tail	1.668	
P(T<=t) two-tail	0.129	
t Critical two-tail	1.995	
Conclusion: P>.05 H0 Cannot be rejected		

Table 3.2: Duration of Fixation on pneumonia image (left) (These results are based on a comparison between

Table 4.2 in Appendix L and Table 3.2 in Appendix H)

Left

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest*

X-ray image of first-year students is not less after training

than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	2.022	1.008
Variance	3.443	1.279
Observations	35	37
Pooled Variance	2.330	
Hypothesized Mean		
Difference	0	
df	70	
t Stat	2.817	
P(T<=t) 1-tail	0.003	
t Critical 1-tail	1.667	
P(T<=t) two-tail	0.006	
t Critical two-tail	1.994	
Conclusion: $P < .05$ H_0 can be rejected		

Table 3.3: Time to First Fixation on pneumonia image (right) (These results are based on a comparison between Table 4.2 in Appendix L and Table 3.2 in Appendix H)

Right

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	1.003	1.329
Variance	0.926	2.477
Observations	36	30
Pooled Variance	1.629	
Hypothesized Mean		
Difference	0	
df	64	
t Stat	-1.031	
P(T<=t) 1-tail	0.153	
t Critical 1-tail	1.669	
P(T<=t) two-tail	0.306	
t Critical two-tail	1.998	
Conclusion: P>05	H0 cannot be rejected	

Table 3.4: Duration of Fixation on pneumonia image (right) (These results are based on a comparison between Table 4.2 in Appendix L and Table 3.2 in Appendix H)

Right

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	1.144	1.5431
Variance	1.128	1.892
Observations	37	32
Pooled Variance	1.481	
Hypothesized Mean		
Difference	0	
df	67	
t Stat	-1.358	
P(T<=t) 1-tail	0.089	
t Critical 1-tail	1.668	
P(T<=t) two-tail	0.179	
t Critical two-tail	1.996	
Conclusion: P>.05 H0 cannot be rejected		

Table 3.5: Time to First Fixation on pneumonia image (Ellipse 3 and left) (These results are based on a comparison between Table 4.6 in Appendix L and Table 3.4 in Appendix H)

Ellipse 3 and left

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	2.619	1.226
Variance	15.486	0.593
Observations	33	35
Pooled Variance	7.814	
Hypothesized Mean Difference	0	
df	66	
t Stat	2.055	
P(T<=t) 1-tail	0.022	
t Critical 1-tail	1.668	
P(T<=t) two-tail	0.044	
t Critical two-tail	1.997	
Conclusion: P<.05 H0 can be rejected		

Table 3.6: Duration of Fixation on pneumonia image (Ellipse 3 and left) (These results are based on a comparison between Table 4.6 in Appendix L and Table 3.4 in Appendix H)

Ellipse 3 and left

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.769	0.836
Variance	0.178	0.284
Observations	38	36
Pooled Variance	0.229	
Hypothesized Mean		
Difference	0	
df	72	
t Stat	-0.599	
P(T<=t) 1-tail	0.275	
t Critical 1-tail	1.666	
P(T<=t) two-tail	0.555	
t Critical two-tail	1.993	
Conclusion: P>.05 H0 Cannot be rejected		

Table 3.7: Time to First Fixation on pneumonia image (Ellipse and right) (These results are based on a comparison between Table 4.6 in Appendix L and Table 3.4 in Appendix H)

Ellipse and right

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	0.574	1.793
Variance	0.293	2.355
Observations	37	35
Pooled Variance	1.294	
Hypothesized Mean Difference	0	
df	70	
t Stat	-4.544	
P(T<=t) 1-tail	<0.000	
t Critical 1-tail	1.667	
P(T<=t) two-tail	<0.000	
t Critical two-tail	1.994	
Conclusion: P<.05 H0 can be rejected		

Table 3.8: Duration of Fixation on pneumonia image (Ellipse and right) (These results are based on a comparison between Table 4.6 in Appendix L and Table 3.4 in Appendix H)

Ellipse and right

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest*

X-ray image of first-year students is not less after training

than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	1.279	0.954
Variance	0.626	0.501
Observations	38	36
Pooled Variance	0.566	
Hypothesized Mean Difference	0	
df	72	
t Stat	1.859	
P(T<=t) 1-tail	0.034	
t Critical 1-tail	1.666	
P(T<=t) two-tail	0.067	
t Critical two-tail	1.993	
Conclusion: P<.05 H0 can be rejected		

Table 3.9: Time to First Fixation on pneumonia image (These results are based on a comparison between Table 4.4 in Appendix L and Table 3.6 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	1.978	1.941
Variance	3.499	3.478
Observations	33	35
Pooled Variance	3.488	
Hypothesized Mean		
Difference	0	
df	66	
t Stat	0.081	
P(T<=t) 1-tail	0.468	
t Critical 1-tail	1.668	
P(T<=t) two-tail	0.936	
t Critical two-tail	1.997	
Conclusion: P>.05	H0 Cannot be rejected	

Table 3.10: Duration of Fixation on pneumonia image (These results are based on a comparison between Table 4.4 in Appendix L and Table 3.6 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	0.646	1.340
Variance	0.308	1.408
Observations	39	38
Pooled Variance	0.851	
Hypothesized Mean		
Difference	0	
df	75	
t Stat	-3.301	
P(T<=t) 1-tail	0.001	
t Critical 1-tail	1.665	
P(T<=t) two-tail	0.001	
t Critical two-tail	1.992	
Conclusion: P<.05 H0 can be rejected		

4. Pneumo-haemothorax

Table 4.10: Time to First Fixation on pneumo-haemothorax image (These results are based on a comparison between Table 2.2 in Appendix L and Table 5.2 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	1.007	1.112
Variance	0.470	0.379
Observations	40	33
Pooled Variance	0.429	
Hypothesized Mean		
Difference	0	
df	71	
t Stat	-0.681	
P(T<=t) 1-tail	0.249	
t Critical 1-tail	1.667	
P(T<=t) two-tail	0.498	
t Critical two-tail	1.994	
Conclusion: P>.05 H0 Cannot be rejected		

Table 4.2: Duration of Fixation on pneumo-haemothorax image (These results are based on a comparison between Table 2.2 in Appendix L and Table 5.2 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.506	0.579
Variance	0.128	0.120
Observations	39	32
Pooled Variance	0.124	
Hypothesized Mean		
Difference	0	
df	69	
t Stat	-0.860	
P(T<=t) 1-tail	0.196	
t Critical 1-tail	1.667	
P(T<=t) two-tail	0.393	
t Critical two-tail	1.995	
Conclusion: P>.05 H0 Cannot be rejected		

Table 4.3: Time to First Fixation on pneumo-haemothorax image (These results are based on a comparison between Table 2.6 in Appendix L and Table 5.6 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	2.267	1.205
Variance	12.774	0.226
Observations	27	38
Pooled Variance	5.404	
Hypothesized Mean		
Difference	0	
df	63	
t Stat	1.815	
P(T<=t) 1-tail	0.037	
t Critical 1-tail	1.669	
P(T<=t) two-tail	0.074	
t Critical two-tail	1.998	
Conclusion: P<.05 H0 can be rejected		

Table 4.4: Duration of Fixation on pneumo-haemothorax image (These results are based on a comparison between Table 2.6 in Appendix L and Table 5.6 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	0.769	0.804
Variance	0.370	0.524
Observations	38	38
Pooled Variance	0.447	
Hypothesized Mean		
Difference	0	
df	74	
t Stat	-0.220	
P(T<=t) 1-tail	0.413	
t Critical 1-tail	1.666	
P(T<=t) two-tail	0.826	
t Critical two-tail	1.993	
Conclusion: $P > .05$ H_0 Cannot be rejected		

Table 4.5: Time to First Fixation on pneumo-haemothorax image (These results are based on a comparison between Table 2.4 in Appendix L and Table 5.4 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	1.559	0.648
Variance	0.605	0.364
Observations	40	24
Pooled Variance	0.516	
Hypothesized Mean		
Difference	0	
df	62	
t Stat	4.919	
P(T<=t) 1-tail	<0.000	
t Critical 1-tail	1.669	
P(T<=t) two-tail	<0.000	
t Critical two-tail	1.999	
Conclusion: P<.05 H0 can be rejected		

Table 4.6: Duration of Fixation on pneumo-haemothorax image (These results are based on a comparison between Table 2.4 in Appendix L and Table 5.4 in Appendix H)

Duration of Fixation on pathology

Hypothesis: Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.484	2.645
Variance	0.062	6.088
Observations	39	27
Pooled Variance	2.510	
Hypothesized Mean		
Difference	0	
df	64	
t Stat	-5.447	
P(T<=t) 1-tail	<0.000	
t Critical 1-tail	1.669	
P(T<=t) two-tail	<0.000	
t Critical two-tail	1.998	
Conclusion: P<.05 H0 can be rejected		

5. Pleural Effusion

Table 5.1: Time to First Fixation on pleural effusion image (These results are based on a comparison between Table 5.6 in Appendix L and Table 6.6 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	1.137	0.405
Variance	0.455	0.093
Observations	30	10
Pooled Variance	0.369	
Hypothesized Mean		
Difference	0	
df	38	
t Stat	3.298	
P(T<=t) 1-tail	0.001	
t Critical 1-tail	1.686	
P(T<=t) two-tail	0.002	
t Critical two-tail	2.024	
Conclusion: P<.05 H0 can be rejected		

Table 5.2: Duration of Fixation on pleural effusion image (These results are based on a comparison between

Table 5.6 in Appendix L and Table 6.2 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	0.639	2.270
Variance	0.359	1.212
Observations	38	10
Pooled Variance	0.526	
Hypothesized Mean		
Difference	0	
df	46	
t Stat	-6.328	
P(T<=t) 1-tail	<0.000	
t Critical 1-tail	1.679	
P(T<=t) two-tail	<0.000	
t Critical two-tail	2.013	
Conclusion: P>.05 H0 Cannot be rejected		

Table 5.3: Time to First Fixation on pleural effusion image (These results are based on a comparison between Table 5.4 in Appendix L and Table 6.4 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	1.090	0.775
Variance	2.858	0.333
Observations	35	30
Pooled Variance	1.696	
Hypothesized Mean		
Difference	0	
df	63	
t Stat	0.973	
P(T<=t) 1-tail	0.167	
t Critical 1-tail	1.669	
P(T<=t) two-tail	0.334	
t Critical two-tail	1.998	
Conclusion: P>.05 H0 Cannot be rejected		

Table 5.4: Duration of Fixation on pleural effusion image (These results are based on a comparison between

Table 5.4 in Appendix L and Table 6.4 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.846	1.881
Variance	0.344	4.129
Observations	36	33
Pooled Variance	2.152	
Hypothesized Mean		
Difference	0	
df	67	
t Stat	-2.927	
P(T<=t) 1-tail	0.002	
t Critical 1-tail	1.668	
P(T<=t) two-tail	0.005	
t Critical two-tail	1.996	
Conclusion: P<.05 H0 can be rejected		

Table 5.5: Time to First Fixation on pleural effusion image (These results are based on a comparison between Table 5.2 in Appendix L and Table 6.6 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	1.578	0.979
Variance	0.599	0.435
Observations	39	32
Pooled Variance	0.526	
Hypothesized Mean		
Difference	0	
df	69	
t Stat	3.467	
P(T<=t) 1-tail	0.000	
t Critical 1-tail	1.667	
P(T<=t) two-tail	0.001	
t Critical two-tail	1.994	
Conclusion: P<.05 H0 can be rejected		

Table 5.6: Duration of Fixation on pleural effusion image (These results are based on a comparison between

Table 5.2 in Appendix L and Table 6.6 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	0.723	1.229
Variance	0.418	0.628
Observations	39	35
Pooled Variance	0.517	
Hypothesized Mean		
Difference	0	
df	72	
t Stat	-3.019	
P(T<=t) 1-tail	0.002	
t Critical 1-tail	1.666	
P(T<=t) two-tail	0.003	
t Critical two-tail	1.993	
Conclusion: P<.05 H0 can be rejected		

6. Pneumothorax

Table 6.11: Time to First Fixation on pneumothorax image (These results are based on a comparison between Table 6.2 in Appendix L and Table 7.2 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	3.498	1.864
Variance	21.729	1.445
Observations	22	40
Pooled Variance	8.545	
Hypothesized Mean		
Difference	0	
df	60	
t Stat	2.106	
P(T<=t) 1-tail	0.019	
t Critical 1-tail	1.671	
P(T<=t) two-tail	0.039	
t Critical two-tail	2.000	
Conclusion: P<.05 H0 can be rejected		

Table 6.2: Duration of Fixation on pneumothorax image (These results are based on a comparison between Table 6.2 in Appendix L and Table 7.2 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.387	0.370
Variance	0.060	0.087
Observations	39	39
Pooled Variance	0.074	
Hypothesized Mean		
Difference	0	
df	76	
t Stat	0.269	
P(T<=t) 1-tail	0.394	
t Critical 1-tail	1.665	
P(T<=t) two-tail	0.788	
t Critical two-tail	1.992	
Conclusion: P>.05 H0 Cannot be rejected		

Table 6.3: Time to First Fixation on pneumothorax image (These results are based on a comparison between Table 6.4 in Appendix L and Table 7.4 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	1.069	3.393
Variance	0.516	17.984
Observations	40	21
Pooled Variance	6.437	
Hypothesized Mean		
Difference	0	
df	59	
t Stat	-3.399	
P(T<=t) 1-tail	0.001	
t Critical 1-tail	1.671	
P(T<=t) two-tail	0.001	
t Critical two-tail	2.001	
Conclusion: P<.05 H0 can be rejected		

Table 6.4: Duration of Fixation on pneumothorax image (These results are based on a comparison between Table 6.4 in Appendix L and Table 7.4 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.439	0.899
Variance	0.127	0.632
Observations	39	39
Pooled Variance	0.379	
Hypothesized Mean		
Difference	0	
df	76	
t Stat	-3.300	
P(T<=t) 1-tail	0.001	
t Critical 1-tail	1.665	
P(T<=t) two-tail	0.001	
t Critical two-tail	1.992	
Conclusion: P<.05 H0 can be rejected		

Table 6.5: Time to First Fixation on pneumothorax image (These results are based on a comparison between Table 6.6 in Appendix L and Table 7.6 in Appendix H)

Time to First Fixation on the pathology

Hypothesis: *Time to First Fixation on the pathology in a chest X-ray image (if present) of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	0.535	0.288
Variance	0.166	0.025
Observations	29	14
Pooled Variance	0.121	
Hypothesized Mean		
Difference	0	
df	41	
t Stat	2.186	
P(T<=t) 1-tail	0.017	
t Critical 1-tail	1.683	
P(T<=t) two-tail	0.035	
t Critical two-tail	2.019	
Conclusion: P<.05 H0 can be rejected		

Table 6.6: Duration of Fixation on pneumothorax image (These results are based on a comparison between Table 6.6 in Appendix L and Table 7.6 in Appendix H)

Duration of Fixation on pathology

Hypothesis: *Duration of Fixation on the pathology in a chest X-ray image of first-year students is not less after training than it was before training.*

t-test: Two-Sample Assuming Equal

Variances

	Variable 1	Variable 2
Mean	1.601	3.418
Variance	3.311	4.682
Observations	39	24
Pooled Variance	3.828	
Hypothesized Mean		
Difference	0	
df	61	
t Stat	-3.579	
P(T<=t) 1-tail	0.000	
t Critical 1-tail	1.670	
P(T<=t) two-tail	0.001	
t Critical two-tail	1.999	
Conclusion: P<.05 H0 can be rejected		

