Thesis Project Portfolio

Computational Flow Dynamics Analysis of Pelvic and Abdominal Veins Using CT, Venography, and Duplex Imaging

(Technical Report)

Animation in Media: How technological context constructs cultural meaning

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Table of Contents

Sociotechnical Synthesis

Technologies often have intersectional usages, a trend which holds true for modeling. While very broad in scope, modeling refers to the creation of a representative volume in some 3D space. Through our capstone team's technical project, we were able to use modeling techniques to reconstruct portions of patient venous anatomy. To further methodologies for investigating Deep Vein Thrombosis, we used our models to run fluid dynamics simulations. Modeling is used in a number of other medical contexts besides fluid flow, and is becoming an important tool for understanding human physiology and pathophysiology. Many of the modeling software and techniques used in clinical settings are also used in art and entertainment fields. My STS research paper in part investigates the use of 3D modeling in the context of animation. I chose to research the sociotechnical relationship between animation and various cultural groups largely due to personal interest in the animation industry. Technology and art have become increasingly combined due to the prevalence of technology in society, making STS scholarship a relevant framework for art. While vastly different in context, my technical work and STS research both hinge on the use of technology which translates 2D spaces into 3D spaces.

Our team's technical project involved the use of 3D modeling and computational fluid dynamics (CFD) to interpret various deep vein thrombosis patient images. We were able to analyze patient CT images, venography data, as well as duplex imaging from the University of Virginia Health System to study the blood flow patterns observed in DVT cases. We analyzed blood flow parameters in patient images taken following stent placement and follow-up images if the patient developed thrombosis. Thrombosis of stents occurs in an estimated 10-20% of patients who experience chronic DVT, the specific reasons for which are unknown. To improve the prognosis of stenting procedures, our work aimed to use image analysis to determine which

specific blood flow parameters most significantly impact re-thrombosis. By performing a comparative study between cases which would develop thrombus and cases which would not, we determined a number of parameters which may be more significant to thrombosis. Additionally, we examined the impact of venous curvature on blood flow parameters. Our work will hopefully expand upon the current understanding of DVT.

My STS research paper investigates the relationship between animation technology and society, specifically the ways in which meaning is constructed through social context. Using the STS framework SCOT, or the Social Construction of Technology, I defend the idea that animation as a technology and practice is socially constructed. By examining both modern and historical examples of animated media, I discuss the cultural and social values laden in animation. There is a focus on western and non-western animation which has become distinctive through cultural interpretations. My research is intended to examine how animation has developed to hold various meanings to different social groups.