**BILKENT UNIVERSITY**

**ENGINEERING FACULTY**

**DEPARTMENT OF COMPUTER ENGINEERING**

**CS 299**

**SUMMER TRAINING  
REPORT**

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# Introduction

I did my summer training at Modsimmer, a company located on the Middle East Technical University (METU) campus. Modsimmer is a modelling and simulation oriented research and development company. I chose Modsimmer because I didn’t have any experience in modeling and simulation and wanted to improve myself in these topics. At Modsimmer, I contributed to an on-going project on Unity, which was a first-aid simulation for military field medics. Medic soldier students would use this program to learn how to analyze and attend the various wounds and injuries on the field. My job was to research and find a proper method to implement liquids in Unity to simulate realistic bleeding effects on injured patients. In my five weeks of internship I learned about human bleeding and ways to attend these wounds, programing in C#, using programs such as Unity, Blender and 3ds MAX. Addition to these technical knowledge, I learned how a company functions, how to work as part of a project group, and the discipline of work life. In the end of the internship I had created a simulation in which a user could click on a soldier body rig and according to the point the rig would bleed accordingly. In this report, I will first give some information about Modsimmer and my supervisor; later I will explain my work week by week. After that I will write my ideas on my performance and finish with a conclusion.

# Company Information

## About the company

Modsimmer stands for Modeling and Simulation Center and it was founded in 1998. METU, Turkish Armed Forces and Undersecretariat for Defense Industries cooperated and brought experts and academics from different disciplines together to research and develop new technologies in the modeling and simulation areas.

[1].

## About your department

During my work period Modsimmer didn’t have different departments. However, there were multiple projects being carried out by intern students and their advisors. All of these projects were computer engineering oriented projects, such as the programming of a robot to map a buildings layout or the writing of a simulation for a Flight-Sim machine.

## About the hardware and software systems

Modsimmer has advanced laboratories such as the Flight-Simulation capsule and the motion capture studio. However, my work was solely oriented towards programming and research; thus, I didn’t have access to these laboratories. I used my own laptop for ease of use and convenience.

## About your supervisor

My supervisor was Dr. Elif Surer. She is an adjunct faculty at METU, GRADUATE SCHOOL OF INFORMATICS. She had graduated from Boğaziçi University, Computer Engineering department in 2005. She got her Master’s degree from the same university in 2007. In 2011 she received her doctorate degree from the University of Bologna (Italy) in Bioengineering. [2]

# Work Done

I will divide this section into 5 parts. Each part will contain information about the work done in a specific week during the period of my internship.

## First Week

My first week at Modsimmer started with meeting with my co-workers and getting settled into my office. Hacer Bilu was a research assistant at METU, Graduate School of Informatics and she was the head of the project. Bekir Oflaz was a 4th year Computer Engineering student at Gazi University. Three of us worked on the same project but we rarely collaborated since our parts were distinct from each other’s.

I started my work with learning Unity since the project was based on Unity and I had no knowledge of it. I started with making a basic ball rolling game which has a tutorial on Unity web page [3]. I also wanted to challenge myself and added additional functions to this tutorial, such as jumping, to understand Unity better. I chose programing in C# since it felt familiar from C++. I had learned in school that with some basic coding I would be able to add additional functions to my ball rolling game.

However, I had a more important task than learning Unity. The focus of my internship was to find a way to implement real-time liquid physics into Unity. My supervisor suggested that I look into programs such as Blender and 3ds MAX where you can create fix animations and find ways to import them to Unity. So I started learning Blender since I had limited knowledge about this program.

## Second Week

Having gained some idea of Unity and Blender, I moved on to do some research about first-aid [4, 5] bleeding and injuries [6]. Knowing different types of bleeding was essential because I had to make liquid animations as realistic as possible according to injury type. I also found some other projects providing first-aid simulations; yet, they were all implemented on different engines such as the Unreal Engine. Since Unreal Engine has built-in liquid physics, the current project would be easier to implement using Unreal Engine. This discovery made me question the suggestion of choosing Unity to implement a project like this. But my supervisor reminded me that our project was for mobile use and Unity was the better choice.

Another important finding of the second week was a Unity plug-in called Fluvio. This plug-in was creating fluid-like particle system within Unity. It worked in real time, so that it was different than animations baked in 3ds MAX. However, my supervisor suggested that I keep working on animations so I stopped practicing Fluvio.

## Third Week

Third week of internship was heavily focused on creating liquid animations in 3ds MAX and exporting them to Unity. I found a tool called Megafiers. Game developers use Megafiers to transport animations they create on 3ds MAX, such as a face mimic, to their game in Unity. By using this tool I was able to transport my liquid animations to Unity but there were several problems. First of all, quality of the liquids were drastically reduced in the transportation. Second and more importantly, once the animation was transferred it was impossible to modify the liquid’s behavior except scaling it. This was a big problem since our project required different types of bleedings (artery bleeding, venous bleeding etc.) and they required liquids with different colors, speeds, velocities and so on.

At the weekly meeting with supervisor we argued this situation. There were some disagreements and she left the decision-making to me. Evaluating the options and thinking about the requirements of the project I chose to use Fluvio plug-in. Fluvio enabled a real-time liquid solution which enabled liquids to interact with other objects in Unity easier, and Fluvio’s library gave us access to many functionalities and ways to customize liquids.

## Fourth Week

After deciding to use Fluvio I spent fourth week learning and practicing this program. Unfortunately there weren’t any tutorials on the internet. None the less, Fluvio’s home page had a great library diagram which helped me with my coding [8]. At the end of the week I was able to simulate a bleeding event. However, this simulation had very poor visuals and needed improvement before I could present it as a finished product.

## Fifth Week

Knowing that this was my last week I started polishing my work and getting ready for my final presentation. With more practice in Fluvio, I was able to produce higher quality fluids. They were looking and behaving more like blood. I started using a soldier model designed by my co-worker Bekir. I tweaked the variables of my codes until I and my supervisor were happy with the looks and the behavior of the bleeding types. After being satisfied with the project I wrote a documentation of the work I had done for the next intern who would continue the project. I added my thoughts to this documentation on how the project can be improved in the future.

# Performance and Outcomes

## Applying Knowledge and Skills Learned at Bilkent

During this internship, I used knowledge gained from my university education very often. First and most valuable knowledge and skill I used was coding in C++. Even though Unity uses C#, I was able to code with C++ syntax, and I used for this project some algorithm patterns I had used in a C++ homework. Self-learning was also a skill I carried from my school life to my summer training. Preparing and presenting slides were also a helpful skill that I used during my internship.

## Solving Engineering Problems

During my internship I had to deal with some engineering problems. The biggest problem was also the reason of my internship; we had to program this game using Unity because it had to run on mobile machines; thus, it had to run on limited resources. This generated two problems. Unity doesn’t have built-in liquid mechanics; thus, I had to find a way to implement it; and secondly, my implementation couldn’t use many resources (meshes, particles, rendering etc.). This leads to unrealistic looking liquids. I had to tweak many options to find a good point between good looks and performance.

Another engineering problem for me was that I didn’t have much information related to the project’s domain (medical field, injuries, treatments etc.). I had to do few days of research to get an understanding of some topics.

## Team Work

Throughout the internship, I was in the same room with Hacer and Bekir. However, our foci were different. I was working on the fluid mechanism, Bekir was working on the interface of the game and modeling objects which would be used in the game, and Hacer was working on the databases. Even though our topics were different we would frequently share ideas on each other’s work. For example, Bekir would say that blood doesn’t look realistic and I would change some parameters. These instant feedbacks helped me. I shared my knowledge with others as well.

## Multi-Disciplinary Work

During my time at Modsimmer, there were only computer science interns doing their summer work. Thus, I didn’t have a chance to work with a person from a different discipline. However, there were several projects on other topics which I had some chance to examine during weekly meetings. For example, there was a project on micro-finance and another one about self-learning robots. Listening and arguing about how they solved the problems that they encountered throughout their internship widened my view.

## Professional and Ethical Issues

During my internship I always tried to be respectful in all my relations. I arrived at Modsimmer on time every morning. When I needed a day off, I let my supervisor and co-workers know this in advance. I used my time at work as efficiently as possible. I kept my work tidy and easy to be followed by others if need be.

## Impact of Engineering Solutions

Our project aimed to help field medic’s training with using tablets. This new approach (simulation) helps schools, armies, governments etc. to save lots of money. Instead of buying expensive training equipment and having to renew or upgrade them, they can use a program again and again and upgrade it easily. An accurate simulation can save a lot more money than its cost. Modsimmer is trying to save some money for the Turkish military and I helped them achieve this with my summer training.

## Locating Sources and Self-Learning

This internship required some self-learning from time to time. First of all, I had to learn Unity platform. Unity’s tutorials helped me with this topic [3]. In Unity, I also coded with C# which I had never used before, but it was similar to C++ so that I didn’t have any problems.

I also had limited information about the medical field related to this project. I had to find and study some basic medical training videos, articles and handbooks [4, 5, 6].

I learned how to use blender and 3ds Max with the help of YouTube video series [7].

The most difficult learning process was learning Fluvio since it didn’t have many tutorials. I used Fluvio’s class diagrams [8] and other documentations provided by the developers in learning to use Fluvio.

## Knowledge about Contemporary Issues

Practicing this internship made me realize how technology was moving towards mobile applications. More and more companies were targeting mobile computing market. Since today’s mobile tools lack the power, this creates an issue for programmers. It limits how much we can do with a mobile application and we need to find ways to work around such limitations. Finding a balance between performance and quality is the new challenge.

Another issue I had was communicating with Modsimmer’s senior personnel. Even though they were specialists in the computer engineering field sometimes it was hard to explain to them the limitations of the programs we were using. I had to create a simulation and show it to them and only then they would understand that it was what they had wanted all along.

## Using New Tools and Technologies

In my summer training I learned of many new tools being used in different areas of computer engineering which makes me happy. I learned how to use Unity and now I am confident with my Unity skills. And after working with Unity I feel like I can easily learn and use other game engines such as Unreal Engine 4.

I learned modeling programs such as Blender and 3ds MAX. These programs gave me an idea about modeling an object, rendering images and videos, and using these objects or images in game engines etc.

# Conclusion

In conclusion, I obtained everything I had hoped for from this internship at Modsimmer. I chose Modsimmer because I wanted to at least have an idea about modeling and simulation in computer engineering. Learning how to use programs like Unity and Blender achieved this goal. I only helped with one part of this on-going project, which was creating and implementing a realistic looking bleeding effect. At the end of my summer training I have achieved this goal as well. I encountered engineering and human issues on the way but this was expected. I solved my engineering problems with my skills from Bilkent or research and by getting help from others. I solved my human issues with my communication skills.

During my internship I tried to observe as much as possible the work life in a semi-government, semi-military company. I learned about the procedures of designing and implementing a project. I observed the relationship between my superiors and engineers. I followed the work ethics throughout my work there.

I feel like this 5-week program was full of experience and learning. Now, I have confidence in simulation and modeling topics next to my coding skills and theoretical learnings in school.

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[8] “Fluvio class diagram”.

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**Self-Checklist for Your Report**

*Please check the items here before submitting your report. This signed checklist should be the final page of your report.*

* Did you provide detailed information about the work you did?
* Is supervisor information included?
* Did you use the Report Template to prepare your report, so that it has a cover page, the 8 major sections and 13 subsections specified in the Table of Contents, and uses the required section names?
* Did you follow the style guidelines?
* Does you report look professionally written?
* Does your report include all necessary References, and proper citations to them in the body?
* Did you remove all explanations from the Report Template, which are marked with yellow color? Did you modify all text marked with green according to your case?

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