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Researching in any specific field is a complex task, that can be undertaken by a group of persons with different backgrounds and/or cultures, on an extended period of time. Depending on the aim and the field of the study, different research methods and methodology have been proposed and developed by the research communities. In this brief essay, I will present and reflect on the research methods I currently use in my research, before discussing some other methods I might consider for future works.

My research field is *Computer Graphics* (aka. CG), and it seems to use mainly two different methods: a variant of the *scientific method* and *State of the Art* reports (aka. STAR reports) which survey, compare and classify the different existing algorithms for a specific class of problems within the field. Sometimes, they also propose new algorithms that fit in holes of the classification presented by the author(s). As I have not worked on any STAR report so far, I will talk solely about the variant of the scientific method I have been using. It can be summarised by the following steps:

1. identify a new problem/shortcomings in previous works;
2. read through the existing literature for similar issues and proposed solutions;
3. identify a possible user of our solution, as it can introduce additional constraints, as well as relax other ones;
4. find a way to solve the issue from step 1 by mixing existing solutions with novel ideas;
5. compare results to previous works if applicable;
6. if results are not satisfying, or if the data analysis yields interesting results directly applicable to the project:
   - if you have been going through many iterations already, restart from step 4;
   - else, think of possible tweaks to the solution that could work better and test them.
7. additional testing and polishing before publishing.

I have only been involved in two research projects so far: a first one which ended in February, and a second one which is still in the early days (close to

step 2), so I feel like I do not have much to reflect upon yet, other than saying that it mainly works and seems relatively close to the variant of the scientific method used by the CG community. However, I do have some small reflections that were included in the overview of the research method I use. One of them is the insertion of step 3 between steps 2 and 4; in the beginning, step 3 was not even present. While we were doing additional testing and polishing on my first project, we realised we had to choose a potential use-case to strenghten our argumentation; out method can support two opposite use-cases. A flaw with the current research method, and to which I do not have a fix, is the multiple iterations over a possible solution. On one hand those iterations can make the solution grow even more and more complex. And on the other hand, we can also forget about some coding decisions we made that can have a significant impact of the results. For example, I needed to initialise a seed for producing random numbers, and went with a constant for the time being: I wanted to get the algorithm running first, before caring of polishing all the details. But I completely forgot about it, until one or two days before the paper deadline. The initialisation of the seed with a constant was not an issue, as we were not claiming an unbiased solution and it could easily be parts of the hacks used by game studios to render nice looking images in a tight time frame. But, by using a number that would change across frames, like the number of frames rendered, to initialise the seed, made the temporal noise clearly visible, and made us realise it was another shortcoming of our method that prevents it from being unbiased.

One aspect of my current research method that I plan to modify is linked to reproducibility of research results. A non-insignificant part of the CG community already publish at least part of their source code, sometimes along with some test scenes, on their webpages. The main goal in this case is not for reproducibility of their results, but rather to help other researchers to compare against their solutions. If some data is shared, it will consist of various parameters used by the authors' models and which 3D scenes were used, but it will not include the position and orientation of the camera, nor of the lights, which are crucial for performance and quality comparisons. Khronos[1] proposed a new representation named *glTF* for 3D scenes, which includes camera's and lights' position and orientation among others, but also which can be extended according to one's needs, making it possible to store algorithms' parameters along the scene rather than hardcoding them. This will hopefully help solve the reproducibility issue, and I plan on releasing glTF scenes along with complete source code of my algorithms. Field studies or consumer surveys will most likely be used if we do any virtual reality related research, as the perception of the user is key. Realism is necessary to achieve a good immersion, but the application still needs to run at a really high frame rate as even a bit of lag can induce nausea for the user. Among the other methods we have seen during the course, none of

[1]Khronos is a consortium made of most GPU manufacturers, Apple, Microsoft, various game companies and universities, and which is responsible for OpenGL/webGL/Vulkan (graphics APIs), OpenCL/OpenACC (compute APIs), OpenCV (computer vision API), among others.

them seem applicable to Computer Graphics. For example, we never enunciate new theorems and therefore never write proofs.