Peer feedback form

Feedback from group:	3
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A. Implementation and experimental design

Obstacle implementation: the assignment was to implement obstacles according to certain criteria: they had to be round(ish), static, roughly half the cell size, and regularly spaced. Please assess if the chosen obstacle implementation meets these criteria:

1	2	3	4	Selection:
There are no obstacles or the implementation is so flawed that it does not allow an answer to the research question.	*Obstacles are implemented but not (fully) satisfy the criteria, which might affect the ability to answer the research question.*	*Obstacles mostly match the criteria. Any issues/bugs/artefacts are minor and have little impact on the answer to the research question.*	*Obstacles are implemented correctly to complete the assignment and answer the research question.*	*3*

Implementation of migrating cells: the assignment was to study collective cell migration where cells keep moving at high densities, using the parameters from self-study exercise 1.3 (the correct choice was max_{act}=80). Please assess to what extent the implementation allows for collective cell migration:

1	2	3	4	Selection:
The implementation is strongly flawed (e.g. cells completely fall apart or do not actively migrate at all).	*The team used somewhat valid parameters, but the chosen max_{act}/λ_{act} do not allow collective motion at high density.*	*The team did not use the correct parameters from ex1.3. Their cells could move at high densities but did not align as in ex1.3.*	*The team chose correct parameters from ex1.3, or equivalent ones allowing migration at high densities <u>and</u> alignment as in ex1.3.*	*4*

Experimental design: to assess the effect of obstacles on collective migration as asked, the simulations should (a) have sufficient cells to exhibit collective migration, (b) be compared against a proper baseline, and (c) ensure that while assessing the effect of a variable of interest, everything else is held constant. Please assess the experiment according to these criteria:

1	2	3	4	Selection:
The # of cells was too low to speak of collective migration; cells mostly did not touch at all.	*There were enough cells that some of them were touching, but not enough to speak of "high densities" per the exercise.*	*The simulation contained an appropriate number of cells to allow for collective migration.*	*There were enough cells for collective migration, <u>and</u> the experiment varied the number of cells to test sensitivity of conclusions.*	*2*
There was no baseline (e.g. only a simulation without obstacles or only a simulation with obstacles), making it impossible to assess the effect of obstacles on collective motion.	*There was a control (e.g. comparing "few" to "many" obstacles), but a no-obstacle baseline was missing making the effect of obstacles on collective motion hard to assess.*	*There was a comparison between a no-obstacle baseline and a run with obstacles, allowing the team to assess how obstacles changed collective motion in this one obstacle setting.*	*Obstacles were varied in a meaningful range (no obstacles to sparse grid to closely packed), allowing a general assessment of the effect of obstacles across various densities.*	*2*

Comparisons between simulations always changed multiple variables at once (e.g. both # cells and # obstacles), preventing meaningful conclusions.	*Some (but not all) comparisons between simulations changed multiple variables at once, limiting meaningful conclusions.*	*[There is no meaningful intermediate here]*	*All comparisons between simulations kept all but one of the variables fixed, allowing a fair assessment of the impact of the changing variable.*	*4*

Other potential problems: there can be other choices in the experimental set-up that might stand in the way of a robust answer to the research question. Check the right column with an X if these problems are present in the report:

Problem	**Explanation**	**Does this apply? (yes/no/maybe)**
Initialization artefacts	In simulations with many cells, you might run into issues where cells fragment into pieces because they are initialized too close together. You are then looking at artefacts, not modelling what real cells might do.	***no***
Stochasticity not considered	The CPM is stochastic, and results may vary between runs. To draw robust conclusions, you should run each simulated condition multiple times – especially in quantitative analyses.	***maybe***
Dynamics not considered	CPM behavior is dynamic and may change over time (e.g. in exercise 1.3: the alignment increased gradually over time). If not considered, you might: - miss important observations (e.g. because you did not wait long enough) - unfairly compare simulations at different time points	***maybe***
Other (please specify):		

Group assessment and feedback: Based on the above, please assess how well the experiment(s) in this report were designed to answer the research question as posited in the assignment. Please write <u>at least 150 words</u> of constructive feedback to help them fix any issues and/or show explicitly which parts were done well. Be specific (which experiment(s) are you talking about?), offer concrete suggestions for improvement and explain why these changes will result in a better report.

Firstly the setting of lamda_V for the obstacle is perfectly correct, increasing lamdaV allows the obstacle to maintain a constant volume. However, I think the volume of the obstacle should be adjusted somewhat. In the article it can be seen that the volume of the obstacle is 500 and the volume of the cell is 100. the experiment requires that the volume of the obstacle is half the volume of the cell. So for example, I think the volume of the obstacle should be around 50 for a cell of 100. In addition, I suggest that some adjustments should be made regarding the definition of obstacle density. Changing the volume of obstacles is able to affect the density of obstacles. Density here means the area of the obstacles over the area of the background. But, I think the required obstacle density in the assignment should mean changing the number of obstacles, given a fixed background area and a fixed volume of obstacles. Since in the previous setup there was a requirement for the volume of the obstacle to be half the volume of the cell. And the number of obstacles is required to be increased. Changing the volume of obstacles is obviously against these requirements.

The second point concerns the number of cells. For the max_act parameter I think it is a very correct choice, this parameter ensures the migratory nature of the cells at high density. However, I suggest that experiments to study different cell numbers should also be added. For example, set up an experiment like this: using the controlled variable method (as you can see it is used in your article, which is highly

recommended), keep the number of obstacles and other parameters constant, and set the number of cells from 1, 20, 50, and more. (The same idea can be used for experiments on the number of obstacles.)

Finally, regarding stochasticity and dynamics I didn't see a clear description in the article, I would suggest that it could be made clear in the article how many experiments were passed to reduce stochasticity and that each experiment was waited for a certain amount of time.

B. Analysis and visualizations

Quantifications: the most robust evidence of any effect of obstacles on collective migration can be provided through some sort of quantification. This does require that your quantification metric(s):

- Is/are measuring the right thing(s)
- Is/are implemented correctly

Please assess the quantitative analysis in this report (if there are none, skip this part):

1	2	3	4	Selection:
There are quantitative analyses in the report, but they do not provide useful information to answer the research question.	*There are quantitative analyses in the report, but their added value is limited.*	*There are quantitative analyses in the report that help answer the research question.*	*There are quantitative analyses in the report that help answer the research question, and they are clearly well-designed and robust (e.g. through proper statistical testing).*	*[choose 1-4]*
The implementation seems incorrect, yielding outcomes that make no sense.	*[There is no meaningful intermediate here]*	*[There is no meaningful intermediate here]*	*The implementation seems correct, yielding reasonable outputs.*	*[choose 1 or 4]*

Visualizations: you were asked in the assignment to add visualizations, which can complement quantitative analyses to show effects of interest. This is most effective if your visualizations:

- Are appropriate in relation to what you are showing (i.e. don't provide a link to a video if a simple screenshot would have sufficed)
- Have a clear and self-explanatory message (e.g., compare simulations side by side, not in different figures on different pages, and provide a meaningful caption)
- Draw attention to the points of interest (e.g. by using colors and/or annotations appropriately)

Please assess the quality of visualizations and figures in this report:

1	2	3	4	Selection:
There are no visualizations at all.	*There are visualizations, but they are not showing behaviors that are relevant for the report.*	*Visualizations are present and mostly relevant and appropriately chosen.*	*Visualizations are present, relevant, and well-chosen for the effects they are showing.*	***4***
Visualizations are not very informative (for example: the message is that cells align, but you cannot see directions in the screenshot).	*Visualizations are somewhat informative, but some relevant information is missing (e.g. comparing two screenshots without a timestamp).*	*The visualization shows the relevant behaviors with necessary information, but presentation could be improved to draw attention where needed.*	*The visualization shows and draws attention to the relevant behaviors, using colors, annotations, and time stamps appropriately.*	*3*
The figures do not support the message (e.g. the relevant simulations are not shown together).	*The figures somewhat support the message, but it is not clear what the*	*The figures are reasonably self-explanatory, but not well supported by captions.*	*The figures are self-explanatory, supported by captions highlighting*	*2*

	message is without reading the main text.		*the message and any relevant details.*	

Description: Any figures/tables should be coherently described and referenced in the results section of the main text, which provides a narrative around the experiment(s) performed. Please assess the quality of this description:

1	2	3	4	Selection:
There is no or barely any text explaining the figures and tables.	*There is a narrative text explaining the results, but it does not reference the figures/tables appropriately.*	*The narrative text explains the results and references figures/tables appropriately.*	*The narrative text explains the results very clearly and references figures/tables appropriately.*	***3***
The text provides some explanations but many relevant observations in figures/tables are left unexplained.	*The text mostly explains the observations but is at times unclear or contradictory.*	*The text explains the observations in detail and correctly, but this causes the main point to be lost.*	*The text explains the observations correctly and in sufficient detail while also remaining to the point.*	*3*

Group assessment and feedback: Based on the above, please assess the quality of the visualizations and analyses in this report. Please write at least 150 words of constructive feedback to help them fix any issues and/or show explicitly which parts were done well. Be specific (which experiment(s)/figures/text sections are you talking about?), offer concrete suggestions for improvement and explain why these changes will result in a better report.

As an example of your answer to Exercise 2, in the article, your description of cell behavior is accurate, for example, you clearly point out the movement patterns of the cells, the speed of movement at high densities. However, I think this phenomenon can be further explained, such as an in-depth discussion of the effect of the parameter Max_Act on the mechanism of cell movement. Also it might be more intuitive to convert the code into a form to present the parameters.

For Exercise 3, the report only mentions the realization of an equally spaced obstacle. I would suggest that some space could be used to describe what the pattern of obstacle placement looks like. For example, the obstacles are arranged in a square with the same number of rows as columns or something like that.

Similarly, for Exercise 5, it is possible to include some explanation of the phenomenon after stating the observation of the cell. For example, why do cells cluster around obstacles? Is this related to the adhesion coefficients between cells, the adhesion coefficients of the cells to the obstacle, and how the obstacle affects the morphology of the cells in a way that causes them to cluster together.

C. Conclusions and evidence

Validity: Claims and conclusions in the report should be backed-up by evidence (figures/tables/etc); please assess to what extent this is the case:

1	2	3	4	Selection:
The report makes several claims that are not backed up by any evidence.	*Most claims are supported by evidence, but the claims are too strong for the evidence presented (e.g. the results could be due to noise).*	*Most claims are supported by evidence, any overclaiming is minor.*	*All claims are thoroughly supported by evidence; there is no doubt that they are valid.*	*3*

Clarity: Ideally, a report should clearly answer the research question with a main conclusion after presenting the results. Assess how clearly the (main) conclusions are communicated:

1	2	3	4	Selection:
There was no clear conclusion, just a description of results.	*Some conclusions were drawn, but there was unclear which were the major and minor points.*	*The main conclusion was clearly highlighted, but it could be explained better.*	*The main conclusion was clearly highlighted and well explained.*	*3*

In addition, please answer the following with Y/N:

	Yes/No
Does this report answer the research question posed in the assignment (and hopefully in the report introduction)? I.e. are the differences between obstacle simulations and the no-obstacle baseline clearly discussed?	***No***
Does the answer mention the alignment of directions in the scenario without obstacles, which is disturbed when obstacles are present?	***No***
Do you otherwise agree with the conclusions made?	***Yes***
Is it easy to find the main conclusions in the report (e.g. in a separate section) and to distinguish it from other observations made?	***Yes***
Is it clear which statements are factual observations ("the cells did X in context Y") and which are interpretations thereof ("these findings suggest that obstacles do X")?	***No***

Group assessment and feedback: Based on the above, assess how well the report answered the research question. Please write at least 150 words of constructive feedback to help the other team fix any issues and/or show explicitly which parts were done well. Be specific (e.g. quote specific claims you disagree with, or specific figures that seem to contradict the conclusion, etc), offer concrete suggestions for improvement, and explain why these will improve the report.

The conclusion section of the current report is combined with the phenomena of the experimental observations and is not summarized separately. If a separate summary were to be made, I think it could be expanded in the following ways.
Starting from the mechanism of cell movement (Hamiltonian Energy), to explain how obstacles affect cell movement. This can be done here from discussing a variety of scenarios, from single cells to multiple cells, and how they differ from each other. A single cell has only cell-to-barrier interactions, while multiple cells also involve cell-to-cell interactions. Analyze the rate, degree of aggregation, direction, and morphology that characterize cell movement without obstacles, with obstacles, and at different obstacle densities. Consider using quantitative metrics as support for conclusions. These data can be obtained from previous experiments. n conjunction with the principles of the model, give a corresponding explanation for why cell migration shows this pattern of movement.

D. Report

Finally, use the questions below to assess if the report is properly structured, clear, and self-contained enough to completely interpret and reproduce the work:

	Yes/No
Does the report clearly state the main research question in the introduction?	***No***
Does the report contain ALL the relevant sections: introduction, methods, results, discussion/conclusion?	***No***
Are there sections of the report that are difficult to read and/or interpret? (If so, please mention those in the textbox below).	***No***
If any literature references are cited: do they seem relevant to the presented work?	***No***

Are there any claims where you think a literature reference is missing?	***No***
Are the methods described sufficiently well that you could reproduce the work *without looking at the code*? This means the report should include: • All the relevant parameters used, including the temperature T and boundary conditions • If adhesion values J are given in a matrix, it should be clear which celltypes are in the rows and columns; • Densities of cells and obstacles (or numbers, but then the size of the simulation field should be included)	***Yes***
Are methods justified?	***No***
Is it clear how long simulations were running before outputs (data/screenshots) were generated?	***No***
Are there any other reasons why results may not be reproducible?	***No***

Group assessment and feedback: Based on the above, assess how the report can be improved. Please write at least 150 words of constructive feedback to help the other team fix any unclear sections and/or show explicitly which parts were done well. Be specific (e.g. quote specific parts where you get confused and explain what you find confusing, etc), offer concrete suggestions for improvement, and explain why these will improve the report.

For an article in the form of a report, I think some structural adjustments could be made. As opposed to simply arranging the results in the order in which the assignment questions were asked. I would recommend more to divide the report into different modules, for example, you can write an introduction, then state the parameter settings, then introduce the experimental arrangement, then state the results, and finally summarize and explain the conclusions obtained from these experiments. Parameter settings and experimental arrangements can be categorized as methods. For the parameter settings, I would suggest that you can describe the meaning of each parameter in the experiment and the reason for setting it to a certain value. For the experimental arrangement, I would suggest that it could be possible to set up a control experiment on the density of obstacles and add the absence of obstacles for comparison. Of course, you can add more control experiments. Maybe also in the results can be added some quantitative parameters to describe the effect of obstacles on cell migration, such as the average speed of cell movement, the overall directionality of cell movement.

E. Bonus simulations (if any)

Some groups may have chosen to perform additional experiments on top of those requested in the assignment. Please assess their added value using the table below:

1	**2**	**3**	**4**	**Selection:**
There are additional experiments, but it is unclear what their goal was.	*There are additional experiments answering specific questions, but their relation to the main research question is unclear.*	*There are additional experiments that allow a somewhat better answer to the research question.*	*The additional experiments add substantial value to the report.*	*[choose 1-4]*
Additional experiments are not well-designed (e.g. missing baseline or varying too many variables at once).	*Additional experiments are mostly well-designed; with some minor flaws.*		*Additional experiments are well-designed to answer a specific question.*	*[choose 1,2 or 4]*
Additional experiments are not analyzed or the analysis is flawed.	*Additional experiments are analyzed in a mostly sensible manner, with only minor flaws.*	*Additional experiments are analyzed in a sensible manner.*	*Additional experiments are analyzed thoroughly.*	*[choose 1-4]*

Conclusions of additional experiments are missing or not supported by the data.	*Conclusions of additional experiments are mostly supported by the data, with minor problems.*	*Conclusions of additional experiments are supported by the data.*	*Conclusions of additional experiments are supported by the data and well-explained.*	*[choose 1-4]*

Group assessment and feedback: Based on the above, please offer suggestions to improve any additional experiments that were performed (if there were none, you can leave this empty).

Your feedback goes here.