We are interested in studying how two different techniques perform for a task where the user has to decide between two routes. In such a task, the user has to go from location A to location B. Two routes that are equivalent in terms of distance allow him to go from A to B. The user has to decide which route is the best choice given that he also wants to perform a number of other secondary tasks (e.g., mailing a letter, shopping at a grocery store, getting some cash) while minimizing the extra distance he has to travel for achieving these secondary tasks. For making an informed choice during the design of such a system, we want to compare the performance of two navigation techniques:

Technique#1:
the Pan&Zoom technique
(pan with mouse dragging, zoom with mouse wheel)

Technique#2:
the Fisheye Lens technique (Figure 1) that magnifies the representation at a scale $z_{Focus}$
(change the lens location with mouse dragging)

In the interactive system we consider, the use case corresponding to this route decision task is as follows:

• the user requests the system to display all the possible routes between A and B
• the system displays the possible routes between A and B on a map with the appropriate zoom level $z_{Context}$ to make both routes fully fit in the viewport
• points of interests (mailboxes, shops, ATMs) are visible only when the zoom level is $z_{Focus}$
• the user has to navigate within the representation to decide which route he will actually follow to go from A to B.

Figure 1: a Fisheye lens provides a detailed view in context
Part A: HYPOTHESES

1/ What is a research hypothesis? Provide a definition and an example of such a hypothesis for the scenario presented above. (1pt)
2/ What is the null hypothesis? Provide a definition and an example of such a hypothesis for the scenario presented above. (1pt)
3/ Why do we need to formulate the null hypothesis for analyzing empirical results? (1pt)

Part B: FACTORS AND MEASURES

1/ What are the relevant factors and measures for the experiment we want to conduct? For each measure, indicate its type (nominal, ordinal or scale). (2pt)
2/ What is a confounding variable? Provide a definition and an example of such a variable for the scenario presented above. How to avoid experimental biases due to confounding variables? (2pt)
3/ Provide an operationalization for the use case presented above, i.e. describe a relevant experimental task for evaluating techniques when the user has to decide between two routes (instructions for participants + sketch the experimental graphical scene). (4pt)