

*Human
Computer
Interaction
&
Information
Visualization*

2019

*An instructional guide to the practical part of the 2019 HCI&IV
course at the Leiden Institute of Advanced Computer Science.*

**Practical
Assignment**

Human Computer Interaction & Information Visualization

Course, Fall 2019.

*Computer Science, Computer Science & Economy,
BioInformatics, Minor CS, Media Technology*

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1 General information

The practical assignment of the Human Computer Interaction & Information Visualization (HCI&IV) course is completed in a team of two persons, unless instructed otherwise by the course administration. The teams are formed under supervision of the course administration by a matching session (19-09-2019). The team is definitive as of 02-10-2019. The list of teams can be found on the HCI&IV course information pages in Blackboard. The group-number given to your team **must** be used in all further correspondence together with the participant names of the team.

After the matching session your team writes a short concept summary (cf. 3.1) containing the idea you wish to explore; these ideas will be reviewed by the course administration. They should fit in the given themes (cf. 6.1-6.4), be feasible and result in a prototype that can be evaluated by the course administration. Each team is assigned to one assistant with whom they will work during the course.

The language of this course is English.

1.1 Assistants

The assistants Lise Stork, Danyi Liu, Lisa Pothoven, Marc Driessen, Max Peeperkorn and Vera Williams (+ name TBA) will provide the practical supervision for the assignment in this course. They will be involved in the evaluation of the documents and intermediate products (prototypes) that your team produces in the run of the practical. In addition, their task is to give assistance in technical problems (implementation issues) and also to notice deficiencies in your plan so as to improve it and make sure you can complete it to a definitive prototype. Moreover, the assistant, being on the work floor, will notice latent shortcomings in the course structure so that we can timely mend problems.

1.2 Team assistant

Each team is specifically assigned to one of the assistants. An assistant is matched to a team on the basis of implementation platform and/or theme chosen. Once the assistant is known to the team all intermediate documents should be sent to the assistant via blackboard. Short comments on the documents are provided via a dedicated team page in blackboard. The course administration will set up initial access to that page and inform the team. The assistants must be approached for problems that do not directly have a technical nature; e.g. change of the work plan, discussion of the approach taken. As soon as your initial plan is approved you will make an appointment with your team assistant to discuss your plan and the approach your team intends to take. The actual scheduling of the appointments is arranged in communication with the assistant. If needed, more appointments can be scheduled. Make good use of the assistance in this course. Except for programming issues, you should exclusively address your assigned team-assistant. If, for some reason, communication fails, contact the course administration.

In the process of completing the assignment at least **3** sessions with the assistant should have been taken place. These discussion sessions with the assistant are **mandatory** and both team members must participate in the sessions. The team is responsible for maintaining contact with the assistant and showing progress with their product/research.

In all cases it is strongly recommended to regularly check the HCI&IV webpage-news section! All information relevant to the HCI&IV course (lectures & assignment) will be published at that URL.

1.3 HCI & IV Lab

If the course requires there will be a few sessions with all course-assistants to group as a whole discussing issues with assignment as well as establishing progress. The HCI & IV lab will enable the assistant to address common problems and discuss these with groups that have come across similar items. There will be a maximum of 2 HCI & IV lab sessions. It is strongly recommended to attend these sessions.

1.4 At the onset of the practical.

What steps need be taken to start the HCI & IV practical?

Please check if you are properly registered through to HCI & IV Blackboard-pages; this is to make sure that the administration has your relevant data and that you can properly submit your items for the course.

Next, you need to think on what kind of theme you would like to work on – the themes for the HCI & IV 2019 course are listed in chapter 6 of this document. Best is to prioritize the themes for yourself. The assignment is completed in a two person team and once a team is formed you need to agree on a theme.

A dedicated session for the formation of the teams is scheduled (23-09-2019); you will **have to** attend this session to talk to several students in the course that are potential team-mates. At the session you decide, according to the rules given, on the formation of a team and you register the team with the course administration.

And now the real work starts. Your team discusses several ideas within the theme that you agreed on. With the idea that you select you think about a research question that you would like to pursue and try to answer. According to the instructions given in paragraph 3.1 you submit your work to the course administration.

Upon approval you will start to further work out your idea in a project plan according to the instructions given in paragraph 3.2; we recommend to have a first meeting with the assistant to learn about some of the comments that were discussed with the course administration in the first evaluation of all projects. Together with the assistant you can decide on the next steps in composition of the project plan.

From here you are on the road, and further instructions in chapter 3, 4 and 5 will help you to shape your project. Templates for presentations and final paper are presented by the course administration. At the lectures some attention will be given to the writing of the paper.

Please take notice of the criteria that we use for the grading of the project, these are listed in chapter 7.

Specific dates and deadlines are given in chapter 8; also contact addresses of the assistants are available here. Enjoy the course.

2 Outline of the practical part

2.1 Aim and choice of assignment

The aim of this practical assignment is to get acquainted with all aspects the interface/interaction development and design process; from idea and interface design up to actual implementation and testing. In this course the focus is on interactive information visualization.

At the onset of the practical period the team discusses possible projects, the project should be chosen in one of the themes in the assignments A, B, C, D. In all cases the project should be chosen such that a well-defined user group can be addressed, aiming to broad will complicate the evaluation. As indicated in the process of this practical part you are getting acquainted with a lot of aspects of design and development of an interface/interaction. The subject of your choice should be accompanied with a **research question**. In general, such question relates to where you think your contribution will be different from other “similar” interfaces/interactions/information displays. It is the leading question in the evaluation and testing phase and it will help you to formulate usability criteria.

2.2 User group

For each assignment a clear and well defined specification of the **group of users** that the design and product is intended for must be indicated. To this respect try to identify a group of users that you can involve in the design trajectory and discuss requirements for the product being made. A well-defined group of users can play an important role in the evaluation and testing of the product. In the rare case you have not been able to find a group of users; you can always discuss the choice for a group “end users” with the assistant and/or course administration. Including users in various parts of the trajectory is, as indicated, important for a successful end-product.

2.3 Documentation and Reports

As part of the assignment a series of intermediate documents need to be produced. The release of these documents follows the outline of this assignment. The outline of the documentation can be described by 5 stages: idea, design, implementation, evaluation and testing. These 5 stages produce respectively, the project plan, the design document, the evaluation and the final paper. The first 3 have their own sub-reports as deliverables. The final paper contains parts of the report and in addition **reflects** on the design process. All summaries of the final reports of the projects that are successfully completed will be included in the abstract book of the HCI&IV 2017 course. The documentation part is further explained in paragraph 3.

2.4 Functional specification

The actual functional specification of your product you are supposed to put together yourselves. Before the first deadline (cf. item 1 chapter 8) you will have to deliver a compact project plan of no more than 4 pages to your assistant. The requirements for the plan and documentation are given in paragraph 3.

2.5 Evaluation & Usability

In order to have your design and implementation evaluated you will address your user-group. At the onset of the assignment identify one user-group. At least two evaluations should be planned (cf. items 5 and 6 in chapter 8) and the results of the evaluations must be discussed with the assistant as well as summarized in the evaluation paragraph of the final paper; the latter should contain the evaluation strategy as well as the remarks on design and implementation. You will use the evaluation of your product to document the revisions that are needed. The planning of the evaluations should appear in your project plan. You may want to do an expert evaluation which can be accomplished by another team. For the evaluation process a handout with guidelines will be made available (hci.liacs.nl). Make sure you discuss the evaluations, before as well as after, with your assistant. In order to support the evaluation process you will have to formulate a **usability specification** that you can use in the trajectory of evaluations. The usability specification will be part of your project documentation; i.e. it should be part of your project plan. New insights can alter the usability specification; in that case you should use versioning to indicate the status of your usability specification.

2.6 Progress Presentations

In the period between 04-11-2019 and 02-12-2019, each team will have to present ideas and progress in a 15 minute presentation to an audience which is a selection of the course participants. These presentations are scheduled on Mondays from 11.15 hrs. to 13.00 hrs. and on Thursdays from 11.15 hrs. to 13.00 hrs. The meetings will be in room 413 of the Snellius Building (cf. item 4 in chapter 8). Attendance to these presentations, as given in the presentation schedule, is **mandatory**; a list will be kept by the administration. Absence at these presentations will be taken into account in the grading of the assignment. Active participation is valued positively.

In order to accomplish active participation of the students we strive at an audience that is not too large and to that end we will provide a schema through which attendance is arranged. For each student this results in a mandatory attendance of **three** meetings (including the presentation).

The presentations are in English – and so are and the discussions.

2.7 Final paper

In the final stage of your project you assemble your work in a paper regarding your activities. This paper is being reviewed together with your (final) product. The paper is formatted in a conference style and a template is being provided (see hci.liacs.nl). The paper may include some aspects on the design you have made in the beginning but you should extrapolate your early findings to the final prototype. In cases where you have failed to meet your specifications you must explain and motivate this thoroughly in your final report for all aspects in your plan. In your final paper you must reason why your system is suitable for the proposed domain and user, i.e. **you try to answer the research question and reflect of the final product and the process.**

The final paper is written in English so that all participants in the course can read and assess the paper.

2.8 Final presentations

In a final meeting with the course administration you present your final prototype together with the paper. The course administration will provide a schema and a format for these presentations. The goal of this presentation is to really focus on the interaction in your final prototype. No other presentation material than your prototype is required. These conclusive meetings are scheduled the beginning of January 2020. The final presentations are open to all participants in the course. These have a conference format and are scheduled in a sequence of thematic sessions.

The final presentations are in English.

3 Project plan, documentation and Project report.

This chapter gives a brief explanation on the (sub)-documents you will have to produce while developing your product. Excerpts from the reviewed documents will be included in the final paper. This paper should be submitted to the course administration (via assistant) in accordance with the given deadline. All the deadlines for these documents are given in chapter 8.

As indicated earlier in this document, the language of this course is English; consequently all documents submitted must be in English.

3.1 *Concept idea & summary*

In order to quickly assess your idea we first evaluate a draft summary that you provide using a standard template. In this phase we might have to reject ideas that are considered not to be feasible in the given time or ideas that do not include sufficient interaction. The concept summary consists of the following items:

1. Title of your project/product
2. Team number and names
3. Intended implementation platform (1 sentence)
4. Intended user group (1 sentence)
5. Research question regarding the idea (1 statement)
6. Summary of your idea (200 words)

The concept idea must fit 1 A4. The concept idea / summary will also be used to assign an appropriate assistant to your team. The summary should therefore be explicit and clear. The same holds for the research question that logically follows from your summary.

The approved summary becomes part of the project documentation and is included in the project report. The summary can in a later stage be adapted to the abstract in your final paper.

Submission of the Concept Idea:

The file, in **pdf format**, should be submitted to the HCI&IV course administration via blackboard. You should use the template-form from the HCI website (HCIIV2019-ProposalForm.docx). Submit as follows (save as) "2019HCIIVteam[##].pdf.

If changes are necessary a revised version, again a **pdf** is submitted to Blackboard. Do **not** send files via email.

3.2 *Project plan*

In your project plan you elaborate on the concept plan. Your project plan, including a time planning, has to be reasonable and practicable. The first part of your plan should contain a compact but reasonably detailed functional specification describing the intended functionality of your product, i.e., the main concepts. This includes the research question that you pose in order to get an interactive product with certain characteristics. Moreover, innovative aspects in relations to competitive products should be clearly stated.

The next part should contain a short description of the user group that you have identified including a motivation that relates the users to the product. In your work plan it should be clearly indicated which user group you will be addressing and how you will realize contact with your user-group.

The following part should contain a description of the innovative aspects of your product and how this relates to the overall theme of Interactive Information Visualization. Here, in addition to your user group, you can specify the types of data that you are going to work with as well as any special transformations that you consider to these data.

At this stage of your project you should also deliver a detailed sketch of a timetable for the project scheduling your activities. This timetable has to be consistent with the provided deadlines. From the moment your project plan has been approved by the course administration, you start with the implementation of your design in accordance with your plan. In short, your project plan should contain:

1. Research question and motivation.
2. Description of interface design
3. Low-profile functional design
4. User group aimed at
5. Innovations aimed at
6. Usability specification (draft)
7. Detailed time-table

The crucial element in your project plan is the description of your interface design where you indicate the relevant design criteria to your future application. Finally, given your ideas, you should develop a usability specification. As mentioned earlier, the usability specification might change while the product is in development. If so, use a versioning to indicate what usability specification will be used in the evaluations. The project-plan document is the next you have prepared and here you elaborate on the concepts presented in your project proposal.

Submission of the Draft Project Plan:

The file, in **pdf format**, should be submitted to the HCI&IV course administration via blackboard. You will use your Team-number for the submission. If changes are necessary a revised version, again as a pdf file, is also submitted to Blackboard. Do **not** send files via email.

3.3 Design document

The next important milestone in the trajectory is your design document. Here the following subjects should be elaborated:

1. Worked out the concept interface design.
2. Sketches (paper) of your design
3. Detailed User analysis
4. Task analysis – if necessary.
5. Sketch of your interface/information display (WireFrames or Hand-drawn)
6. **Usability Specifications** for testing of your prototype.

The design document is an extension to your concept proposal and can be submitted as such. Therefore, at completion of your design document you can finalize your concept proposal.

Submission of the Design Document:

The file, in **pdf format**, should be submitted to the HCI&IV course administration via blackboard. You will use your Team-number for the submission. If changes are necessary a revised version, again as a pdf file, is also submitted to Blackboard. Do **not** send files via email.

3.4 Evaluations

In your timetable you must plan at least **two** evaluation sessions. The results of both evaluations should be reported. The user-group that participates in the evaluation should be given clear instruction as to how to do the evaluation. These instructions must be provided in the evaluations section of the project report (cf. paragraph 5). Next, also your response and actions as a result of the evaluation should be included in the evaluation section of your project report.

For the evaluations you have defined a usability specification that you will use in the explanation of the results of the evaluation.

Submission of the Evaluation reports:

The files, in **pdf format**, should be submitted to the HCI&IV course administration via blackboard. You will use your Team-number for the submission. Do **not** send files via email.

3.5 Overall Reporting & Final Paper

The final paper consists of the compilation of the intermediate documents that have been reviewed by the assistant. The following sequence is useful: summary, project plan, design document and the evaluation. The conclusions and discussion should be included as the last section in the HCI&IV report.

Make sure that in compiling all sub documents the result is consistent in style and reasoning. If you have taken a different path as a result of the evaluations, make sure that this is well described in the final paper. Given the final prototype this might require special attention. Consistency with your prototype is assessed. A template for the final paper is available on the website (hci.liacs.nl).

Submission of the concept Final Paper and Final Paper:

The files, in **pdf format**, should be submitted to the HCI&IV course administration via blackboard. You will use your Team-number for the submission. Do **not** send files via email.

4 Implementation and review

For the implementation it is advised to use a model/view/controller-architecture as discussed in the course book (Benyon., 2010; Ch. 15, 2nd ed.; 2013, Ch. 12, 3rd ed.). If you decide to diverge from this architecture you should provide a clear motivation in your reports. The actual construction of the information display should, of course, offer some of the main functionality, but for this practical of the course the usability aspects of your information display bear much more weight. A limited but good information display is appreciated over a fully functional bad information display. Manage your time carefully so that you can optimize the product that you are developing. Consider integrating an optional time slot in your planning for adding more functionality to your product.

The software platforms that are recommended for this assignment are:

	Software Platform	Assignment Theme
1	Java (JRE2/Processing)	A,B,C,
2	JavaScript/D3	A,B,C,D
3	Unity	A,B,C,D
4	Android/iOS Dev. Kit.	A, D
5	Visual C++ with QtDesigner	D
6	Python, with specific api's	A, B, C, D

Most of the software platforms are available on the student-computer rooms (302/304/306/308). Other tools or libraries are negotiable. However, you should realize that it cannot be expected that assistants support all of these programming languages and development kits.

The product should execute on either of these platforms:

1. Windows 10
2. MacOS X
3. Ubuntu/Debian/Fedora Linux
4. iOS/Android

Internet applications should run within (latest versions):

1. FireFox
2. Google Chrome

The choice of software tools and platform is part of your project plan. With the users group in mind you can motivate that choice in the project plan.

In this course the emphasis is on design and evaluation of a user interface which is driven by a well-defined research question. In order to make the features of your design more realistic you can add functionality as your time schedule allows. It will certainly contribute to the ideas you are trying to convey with the product. The actual code for your implementation is not directly relevant for your grade. However, the course assistants should be able to deduce from your code how you have implemented your interface-architecture. Instead of a judgment on source code, you will have to explain your design and implementation and their relations in the discussion/review of your final paper with the course personnel (cf. item 8 & 9 in chapter 8).

5 Evaluations

As a team you must have identified a user group for the product. From this user group make a representative selection of *at least* two (2) persons. Hopefully you have been able to make future users enthusiastic about the potential of your interactive information display and consequently they are willing to participate in an evaluation of your product. You have to make sure that availability of the potential users fits in your project schedule. Participation of real users is essential and very much appreciated; it will certainly enrich your views on the design process.

In some special cases you may wish to assemble information by a specialist panel. For specialist evaluations it is preferred that you address one other team to participate in the evaluation. In all cases the results of the evaluations should be reported together with the instructions that were given with the evaluation.

As mentioned, at least two evaluations of the work in progress are required. The evaluations may result in adjustments at the design and implementation level (cf. Star-lifecycle model). You should pick at least one suitable evaluation method from the book/lectures and apply this method to your product. As indicated in paragraph 3.4, the results should be included in the evaluation part of the project report. All evaluations you complete as well as the revisions to the product that have been applied afterwards will be taken into account for your final grade.

A document with guidelines for the evaluations and the report on the evaluations will be made available. In addition you can use a sample questionnaire list typical for HCI&IV related projects; this is provided as well and can be extended for the given product and evaluation task.

In addition, as indicated, you have formulated a **usability specification**; make sure that these specifications are checked by your assistant so that you can make sure that they will serve the intended goal. Discussion on the usability specifications will also result in a better specification. Progressive insight might alter the specification, this is not a problem, however, make sure this is well documented and include a motivation in the final paper.

6 Themes in HCI Assignment 2019

In this practical assignment the overall theme is **interactive information visualization** and in this theme we will distinguish four sub-themes. These themes are chosen such that the team can use imagination in defining a product within that theme. In all cases you should **actively seek** contact with the **future users** of your product and involve the users in the design process (evaluations). The extent to which you have realized involvement of users in the design process will be taken into account in the grading of the project.

In addition, all products must show **innovation** and the aspects of innovation have to be dominantly present in the interactions and interface. Innovations are related to the **research question**. The innovations that are aimed at should be mentioned in the project plan. Innovation and the realization thereof will be taken into account in the grading of this project.

Interactive Information Visualization is characterized by rich interaction, adaptation of the Focus and Zoom mantra, a user centered design and usability engineering towards the final realization.

The entire course personnel will first evaluate all concept ideas/summaries. Ideas that are not well structured or unrealistic in their implementation will be rejected. In these cases a new plan has to be submitted and assessed.

6.1 Theme A: Interactive Information Displays

This theme is concerned with the development of an application in support of collections of information that is offered in a playful interactive manner. This can be inspired by an existing application; however, your team will investigate new (and better) ways of interactive exploration of a certain collection of data; as an example we presented music collections but use your imagination for other types of collections that will benefit from an interactive information display.

Given a thorough analysis of existing applications redesign can be proposed and elaborated. From inspiration of existing applications you can develop ideas and directions to make significant improvements. If you use an existing application, the starting point is to take its functionality but not its interface. In this manner the idea is there but the interface and interaction need be developed *de novo*.

Of course completely new ideas for information displays can arise and should be probed – e.g. a new interaction device can change the way an information display is dealt with.

6.2 Theme B: Interactive Visualization of Networks

The goal of this assignment is the design and implementation of an interactive information display that supports connection between people/items. Such can be typically achieved with InfoVis applications in which context is added to connections. The visualization is interactive and possibly supports dynamics in that it shows changes over time or it is able to continuously include new data. There are ample examples available in *processing* (<http://processing.org>); for inspiration look at: <http://flowingdata.com/category/visualization/network-visualization/> Resources from code repositories allow developers to create mash-ups. Important to this theme is the way the connection between data is presented to the end-user. What is a good amount of data to render to the information

display without causing an information overflow? Connecting people can also refer to the coupling and/or augmenting of a dataset with data from a different, and maybe surprising, source.

This theme build as web-interface, e.g. with D3, it is however not restricted to such platform. Different devices can be considered to realise a good interaction (e.g Video Wall, Kinect, Leap Motion, VR devices). Innovative aspects should be considered and derived from explorative studies, available solutions, literature and Internet.

6.3 Theme C: Information Visualization of Scientific Data

Scientific software has interactive components. The software is often used by people involved in science but not per se with an extended computational background. Interactive Visualizations should be designed such that learnability and in particular memorability is optimized. Projects with this theme are often elaborated on within a team of scientists or developers. The team will be asked to elaborate the interaction/interface for a specific part of the software. It is stimulated to present an idea of the team itself. These information visualizations are focused on finding new means of interaction and ways to highlight complex patterns in the data.

Science comprises large collections of data. Building an intelligent interactive information display for such collections is the aim for this theme. Collections can be from NASA, the Leiden Observatory, Industrial Ecology, NeuroScience and many others. The course administration can be requested for a specific project.

6.4 Theme D New Interactions.

In this theme an interaction that is new to an application is explored and elaborated. The basic idea is that changing the interactivity through the use of specific devices will enhance and improve the application and even allows adding new functionality. The theme has characteristics of InfoVis but can be applied to other fields. The focus is on investigating the new interaction and evaluating the advantages and disadvantages. Such interactions sometimes involve new devices or installations including these devices. One should specifically keep in mind that the project should be feasible in the time given. Some examples will be presented in the lectures. It is recommended that within the team a good knowledge of hardware and communication protocols is present.

7 Grading of the assignments and HCI Design criteria

The grading will be based on a number of aspects. The initial project plan will be graded with sufficient (you may proceed with minor revisions) or insufficient (serious revising is necessary).

7.1 Grading

Important aspects concerns the planning, punctuality, progress, etc., with which you carry out the project. You will be (sub-) graded for each milestone along the design process. The following milestones are specifically graded:

- Project Plan, PM;
 - Revised Project Plan (after review);
 - Design Document;
 - User evaluation (1) + response*;
 - User evaluation (2) + response;
 - User evaluation (N) + response; (if applicable)
 - Presentation /Attendance/Participation;
 - Final prototype + Final paper.
 - Final review/discussion by course personnel;
- * with response we mean how the results are used in the product development

Besides the time management and overall management of the project the grading is based on a number of aspects relevant to the field of Interactive Information Visualization. The final grade for your assignment is a weighted average of each of these sub grades. Your final grade for the HCI&IV course is made up of both the exam grade and the assignment grade, as follows: provided that both the result of your written exam (T) and your practical assignment grade (P) are ≥ 5.5 the final grade is: $HCI = 0.65 \cdot P + 0.35 \cdot T$

Grades will be valid for one year if one fails on one of the parts of the course; after a year, the student has to redo the complete course. Note that the result for the written exam is the average of the 4 tests.

7.2 Physical design criteria

- screen-layout
- icon design, glyph/geom use.
- navigation
- expertise level
- interaction
- input devices
- coherence between windows and components, etc.

7.3 General design criteria

- problem statement (including user/task analysis)
- usability specifications
- prototyping
- evaluation
- documentation

8 Deadlines

Deadlines are handled very strict by the course administration. Late submissions will not be taken into consideration for evaluation and grading. Keep yourself informed on possible changes in the course schedule. These changes will be posted on the HCI information pages. If in doubt, contact your assistant.

	Document or Product	Due Date (= deadline)
0	Concept Summary	September 30, 2019 , 12.00 hrs
1	Project plan	October 14 2019, 12.00 hrs
2	Revised project plan	In correspondence with assistant
3	Design Document	Specified in project plan
4	15 minutes presentation to course participants	According to schema provided [3-11..5-12]
5	User evaluation 1	Specified in project plan
6	User evaluation 2	Specified in project plan
7	Concept Project Paper	December 20, 2019 , 12.00 hrs
8	Final Project Paper	January 6, 2020 , 18.00 hrs
9	Final Product (Prototype)	January 7, 2020 , 18.00 hrs
10	Final presentation with course administration	January 9-10, 2020*

* Small changes in the time-table might be required in correspondence with course schedules.

9 Relevant email addresses and links

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Contact	Content
Prof Dr. Ir. Fons J. Verbeek	Lectures, Book & Reading assignments, Practical assignment, Course supervision
Dr Lu Cao	Practical, Schedules, Issues in teams, Course supervision
Assistants	Practical Issues in Assignment. Deliverables according to your Time Table.

URL	
September 2019	http://hci.liacs.nl
September 2019	https://blackboard.leidenuniv.nl/ [HCI&IV course pages]
October 2019	http://hcidemo.liacs.nl [HCI&IVdemo pages]

FJV September 2019