Discussion Notes

1. Main point of the paper as the authors sees it – Ealaf Selim
   - Firstly, it was mentioned that this work is different from the previously discussed paper (Mechanics of collaboration), because it revolves around design;
   - Demand for digital information is increasing, but still both paper and digital media are used nowadays. People “haven’t yet escaped” paper, because the computer environment is not as adequate for collaborative work. This may present an issue, since time is wasted in the process of translating a digital content to paper, and then registering back from paper to digital format;
   - By reviewing and analysing the literature in tablets, HCI, CSCW and Social Sciences, the authors have come up with eight design guidelines, for supporting collaboration in digital tabletop environments:
     1. **Support Interpersonal Interaction**:
        - o Provide means to support communication and awareness among collaborators: support for mechanics of collaboration;
        - o Even if there is no need for explicit support for each mechanic, at least it should not to get in the way;
     2. **Support Fluid Transition Between Activities**:
        - o Switch back and forth from different activities (ex: drawing and writing);
        - o Universal input device would favour this transition, but specialized input devices may be more adequate for optimizing tasks;
        - o Issue usually avoided by most tabletop systems, by focusing on a single type of activity (e.g. sketching only, or moving objects only);
     3. **Support Transitions Between Individual x Group Work**
        - o People flow naturally between individual and group work when collaborating. Usually there are specific areas for each to occur - personal space and group space - and supporting the maintenance of those areas may facilitate transitions between individual and group work;
        - o Some possibilities for a personal space: partitioning the tabletop space (software); providing separate display (hardware). Nonetheless, how to best support individual work x group work is still undefined.
     4. **Support Transitions Between Tabletop Collaboration x External Work**
        - o Support the incorporation of previous work into the collaborative environment;
Transferring files across a network or using storage devices may be cumbersome. But there are some solutions that support an easy transfer of files between computers, as if you were transferring data from ‘one display to another’.

5. **Support the Use of Physical Objects**
   - Tabletop systems provide surface for placing items: from notebooks (task related) to coffee cups (not task related), a favourable scenario for the use of objects.
   - TUIs (tangible user interfaces) have been used as alternative input (e.g. using bricks for rotating, moving, resizing objects);
   - There are several approaches for tracking objects on a tabletop, such as computer vision and RFID tags.

6. **Support Shared Access to Physical and Digital Objects**
   - Shared work surface is an important collaboration resource; shared artifacts also help maintaining group focus and awareness.
   - Orientation is a relevant issue concerning shared objects: it may either favour or hinder group interaction. Therefore, it is important to provide user-controlled, flexible orientation for shared objects.

7. **Support Flexible User Arrangements**
   - People may be distributed around a table in many ways, depending on the context, or the task. For example, children prefer sitting close to each other in a side-by-side arrangement, in contrast to adults, which usually sit in a face-to-face or corner seating arrangement.
   - Orientation is also an issue here, as the displayed information may not be properly oriented to all users, depending on their distribution around the table.

8. **Support Simultaneous user actions**
   - People commonly interact and work simultaneously on the table surface. Also, they have many different group work styles: parallel work, sequential work, independent work, among others. On single-touch systems does not always provide the adequate support for these styles.
   - Now a very common concept, multi-touch functionality was still rare among computer systems by the time this paper was written.

Finally, several directions for future research were highlighted:

- **Standardization of methods to evaluate co-located collaboration**;
- **Perform comparative studies on systems configurations**;
- **Investigate which tasks are most suitable for tabletop collaboration**;

2. **Main point of the paper as you as a reader see it – S. M. Sohan**
   - It was highlighted that the 8 guidelines list comprised a good introduction to tools, for a person new to tabletops. It was also mentioned that it is good to have an explicit list of guidelines.
   - Digital tabletops should add some value to traditional tabletops. In a traditional setup, for instance, people usually use papers/drawing surfaces and someone digitizes the final version. It often goes through some revisions as well. Using digital tabletops may add value by saving cost and time.
- It was clear that digital tabletops must not interfere or harm natural collaboration. This is true for both hardware and software.
- Digital tabletops should automatically understand the mode without an explicit user action. For example, when switching between writing to drawing, this transition should just be fluent.
- Different input methods like physical objects (TUIs), drawing charts, and multi-touch should be used where appropriate.
- Lessons Learned:
  - Available tools - PDH, BEACH, i-LAND, PASSAGE, AUGMENTED SURFACE, CAFE' TABLE, METADESK, Hyperdragging and so on.
  - Think about orientation and issues with collaborating using text intensive materials.
- Some general comments:
  - Orientation is still an open question;
  - Multiple touches still lack tracking speed;

**Open Discussion: 4 interesting points on Sohan’s critic, pointed up by Sheelagh:**

1. ‘Do no Harm’ is a low level goal. It means to offer no hindrances to the collaboration, or the task being performed.
2. The concept of ‘augmenting’, of going beyond reality: that is, there should be something ‘else’ in the digital world to complement, to improve the user’s experience, compared to the ‘real world’.
   - Which leads to an important question: Why use tabletops?
3. ‘Mode-less’: the awareness of perceiving task changes and adapting to it. For example, realizing that a writing activity has finished, and a drawing activity has started. You don’t need to have a ‘switch’ to turn certain mode on;
   - Very difficult to achieve in a group situation;
   - Incorporating A.I. (“Making the system smart”) was one of the main suggestions to implement this feature, e.g. recognizing handwriting and identifying that the user is writing;
     i. It was also stated that technology for this is challenging: how to identify when switching from drawing to writing?
     ii. Context was considered is a relevant aspect to consider, since it would give clues to help figuring out what is trying to be done. But in the end, handwriting recognition still needs to evolve;
     iii. If someone finds a way to switch between modes without explicit user interference, it is clearly a research contribution;
- ‘Re-purposability’
  - Objects in real world are re-purposable: think that you need to drive a nail into a piece of wood. You automatically think of a hammer for that task. But, if you don’t have a hammer available, you could also use a rock or a brick;
  - Using this analogy to computer systems: is it possible to make such a component that is re-purposable, interface that have such characteristics?
  - This is a concept more and more present nowadays. How could we incorporate it to our future work?
3. How this paper applies to moving this research forward and to our research?  
– Jamie Starke

- As a personal impression, it was mentioned that current paradigm of ‘1 computer ⇔ 1 user’ doesn’t work for multiuser co-located collaboration. Besides this, is was observed that the work gives a fairly broad overview of what work actually has to do with the 8 guidelines, and where there are still some unanswered questions (such as “How best to support a transition between spaces”);

- A benchmarking on paper for evaluating digital tabletops was suggested, defending that it is the standard for multiuser collaboration:
  - This comment brought back the “Go beyond reality” discussion on the last section: digital tabletops systems should not just try to emulate paper, they need to have extra features that can be provided by digital means;
  - But it was agreed that paper still offers possibilities not yet covered by tabletop systems. The goal, then, is also to ‘do everything you can do on paper’, except reproducing the physical characteristics of the paper itself.

- It was also stated that evaluation methods should be standardized, and studies should be more comparable. This would favour our understanding on the impact of different configurations, and determine what tasks are more suitable for tabletop collaboration.

- A discussion began also on the previous comment of ‘seeing digital tabletops as a real table: “It may sound weird, to put a coffee mug on a thousand dollar surface. Also, you don’t necessarily need to see it as an ordinary table”.

- It was also discussed how text input is still an open question for digital tabletop environments, and how use of keyboard may be cumbersome. Also, ‘collaborative activities plus keyboards’ present an even more challenging scenario.