TIW 8
Technologies Web synchrones et multi-dispositifs

Ubicomp Web

https://aurelient.github.io/tiw8/

Plan

- **L’informatique Ubiquitaire**
- Design Adaptatif
- Reconnaissance de Gestes

L’informatique Ubiquitaire

Un peu d’histoire:

- Mark Weiser et le Xerox PARC
- En Europe :
  - i-LAND
  - Phillips
- Aujourd’hui

L'Ubicomp : 3e ère de l'informatique

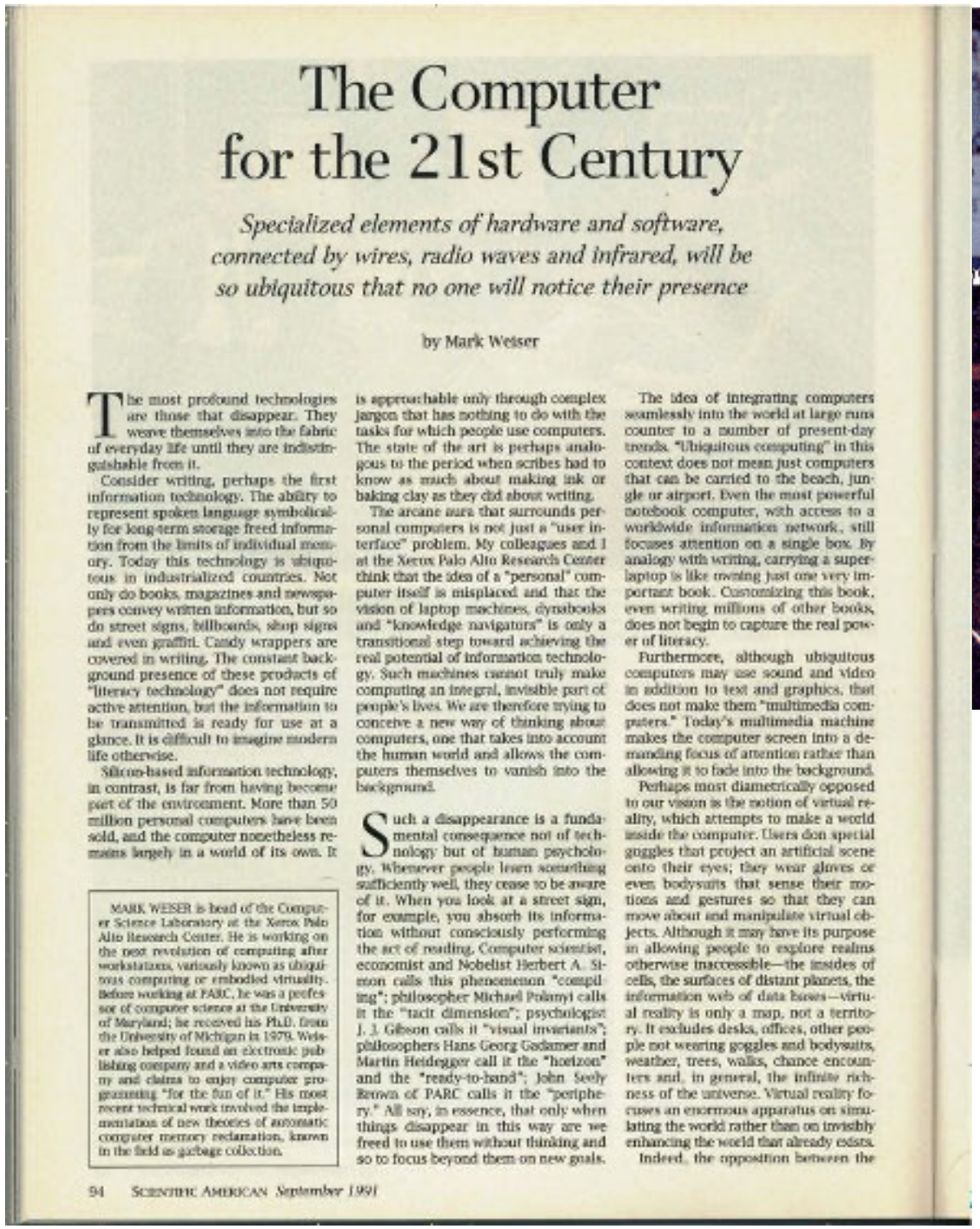
Fin des années 1980 - début 90 :

- L'informatique personnelle s'impose (Mac: 84, Windows 3: 90)
- Miniaturisation de l'informatique
- Informatique embarquée, premier téléphone mobile, Palm…
- Développement d'interfaces utilisateurs grand public
- Salles interactives, réalité augmentée…

De nombreux termes:

- Ubiquitous computing (Xerox)
- Pervasive computing (IBM)
- Intelligence ambiante (UE)

Mark Weiser — Le père de l'Ubicomp



The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.

Consider writing, perhaps the first information technology. The ability to represent spoken language symbolically for long-term storage freed information from the limits of individual memory. Today this technology is ubiquitous in industrialized countries. Not only do books, magazines and newspapers convey written information, but so do street signs, billboards, shop signs and even graffiti. Candy wrappers are covered in writing. The constant background presence of these products of "literacy technology" does not require active attention, but the information to be transmitted is ready for use at a glance. It is difficult to imagine modern life otherwise.

Silicon-based information technology, in contrast, is far from having become part of the environment. More than 50 million personal computers have been sold, and the computer nonetheless remains largely in a world of its own. It is approachable only through complex jargon that has nothing to do with the tasks for which people use computers. The state of the art is perhaps analogous to the period when scribes had to know as much about making ink or baking clay as they did about writing.

The arcane aura that surrounds personal computers is not just a "user interface" problem. My colleagues and I at the Xerox Palo Alto Research Center think that the idea of a "personal" computer itself is misplaced and that the vision of laptop machines, dynabooks and "knowledge navigators" is only a transitional step toward achieving the real potential of information technology. Such machines cannot truly make computing an integral, invisible part of people's lives. We are therefore trying to conceive a new way of thinking about computers, one that takes into account the human world and allows the computers themselves to vanish into the background.

Such a disappearance is a fundamental consequence not of technology but of human psychology. Whenever people learn something sufficiently well, they cease to be aware of it. When you look at a street sign, for example, you absorb its information without consciously performing the act of reading. Computer scientist, economist and Nobelist Herbert A. Simon calls this phenomenon "compiling"; philosopher Michael Polanyi calls it the "tacit dimension"; psychologist J. J. Gibson calls it "visual invariants"; philosophers Hans-Georg Gadamer and Martin Heidegger call it the "horizon" and the "ready-to-hand"; John Seely Brown of PARC calls it the "periphery." All say, in essence, that only when things disappear in this way are we freed to use them without thinking and so to focus beyond them on new goals.

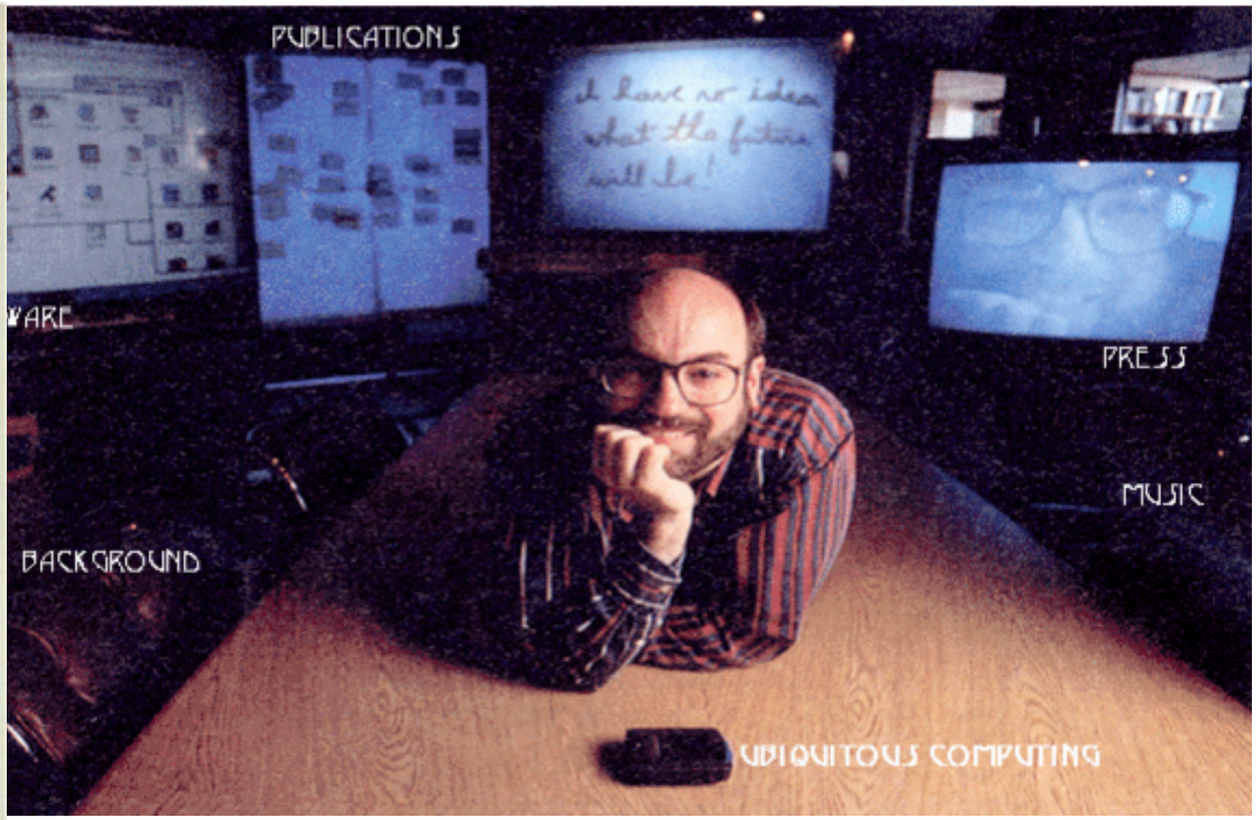
The idea of integrating computers seamlessly into the world at large runs counter to a number of present-day trends. "Ubiquitous computing" in this context does not mean just computers that can be carried to the beach, jungle or airport. Even the most powerful notebook computer, with access to a worldwide information network, still focuses attention on a single box. By analogy with writing, carrying a superlaptop is like owning just one very important book. Customizing this book, even writing millions of other books, does not begin to capture the real power of literacy.

Furthermore, although ubiquitous computers may use sound and video in addition to text and graphics, that does not make them "multimedia computers." Today's multimedia machine makes the computer screen into a demanding focus of attention rather than allowing it to fade into the background.

Perhaps most diametrically opposed to our vision is the notion of virtual reality, which attempts to make a world inside the computer. Users don special goggles that project an artificial scene onto their eyes; they wear gloves or even bodysuits that sense their motions and gestures so that they can move about and manipulate virtual objects. Although it may have its purpose in allowing people to explore realms otherwise inaccessible—the insides of cells, the surfaces of distant planets, the information web of data bases—virtual reality is only a map, not a territory. It excludes desks, offices, other people not wearing goggles and bodysuits, weather, trees, walks, chance encounters and, in general, the infinite richness of the universe. Virtual reality focuses an enormous apparatus on simulating the world rather than on invisibly enhancing the world that already exists.

Indeed, the opposition between the

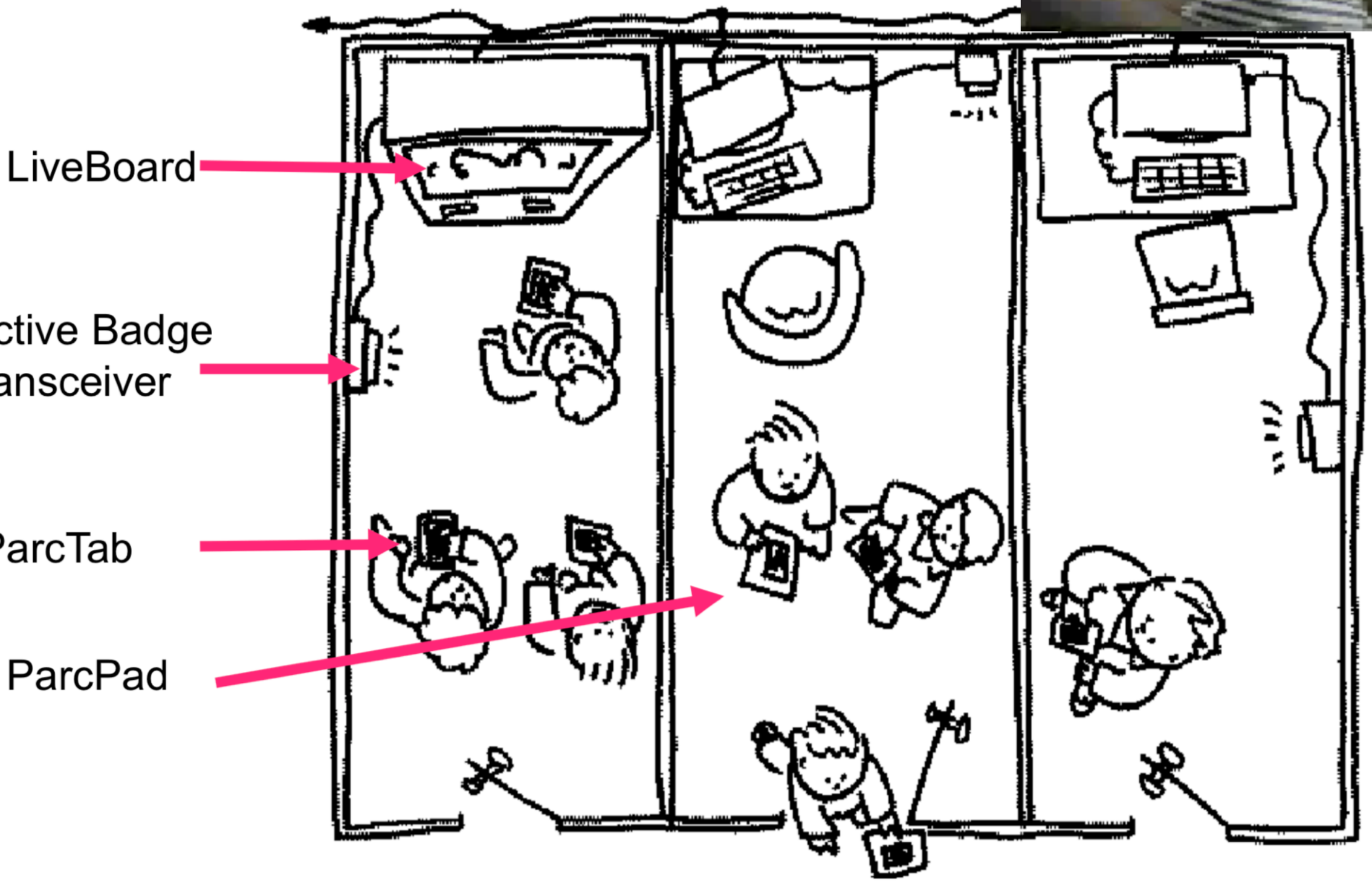
MARK WEISER is head of the Computer Science Laboratory at the Xerox Palo Alto Research Center. He is working on the next revolution of computing after workstations, variously known as ubiquitous computing or embodied virtuality. Before working at PARC, he was a professor of computer science at the University of Maryland; he received his Ph.D. from the University of Michigan in 1979. Weiser also helped found an electronic publishing company and a video arts company and claims to enjoy computer programming "for the fun of it." His most recent technical work involved the implementation of new theories of automatic computer memory reclamation, known in the field as garbage collection.



Formule une vision de l'informatique diffuse, dans l'environnement et les objets de tous les jours.

https://www.lri.fr/~mbl/Stanford/CS477/papers/Weiser-SciAm.pdf

À Xerox Parc



Computing by the inch, foot, & yard

Ubiquitous computing
@ Xerox PARC, 1988 - 1995

Devices according to model size approach:

PARCtab	PARCpad	Liveboard
Inch-sized	*Foot-sized*	*Yard-sized*

Échelle, continuité

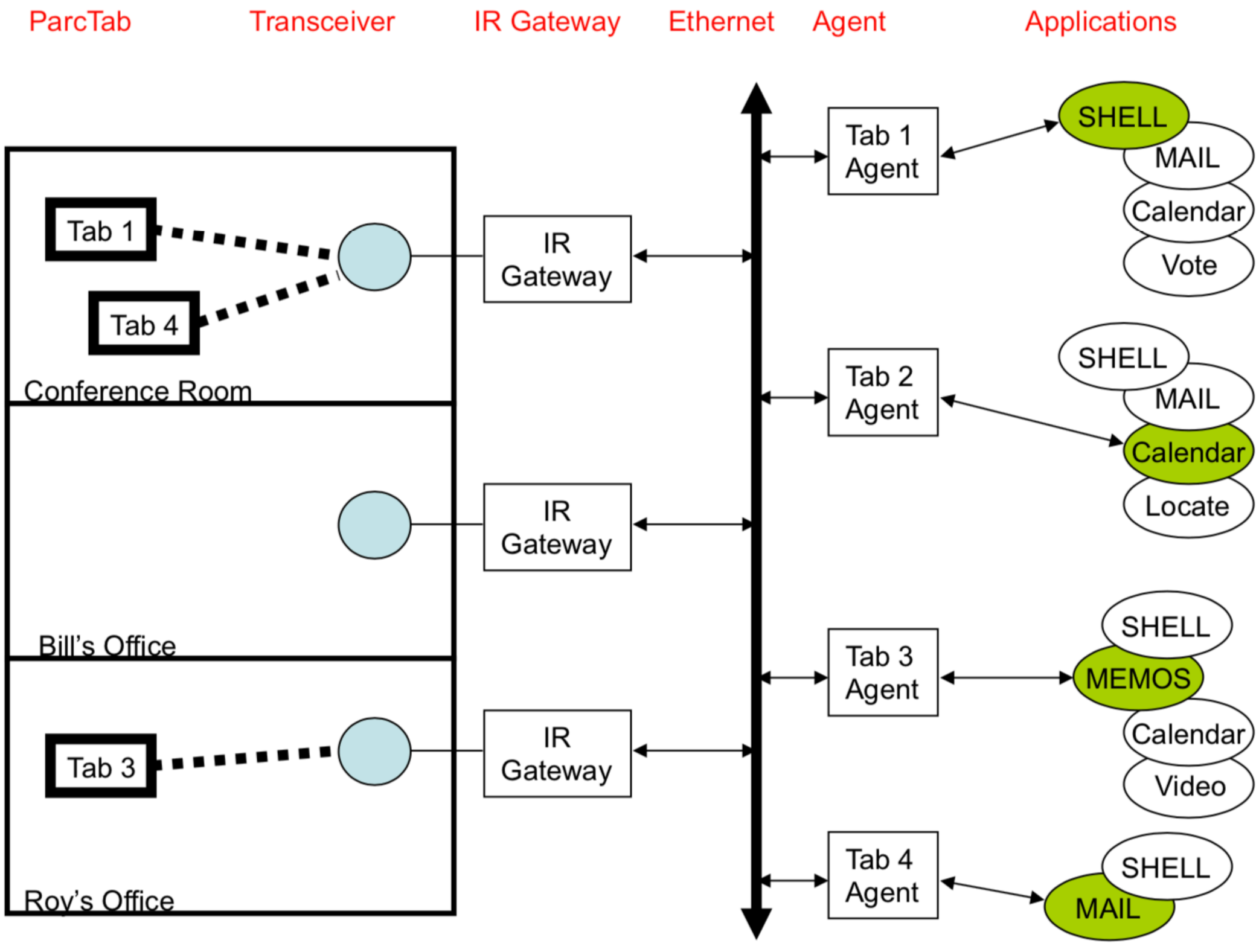
tiny	**~ book size**	**> meter**
Every pixel counts **Context Aware** **Pervasive**	**Action at point of input** **Error handling & disambiguation** **Disposable or personal**	**Fluid interaction** **Freeform input** **Shared collaborative**
PARC Tabs **hundreds/person**	**PARC Pads** **tens/person**	**Liveboard** **one/person**

Tabs

“Tabs are the smallest components of embodied virtuality. Because they are interconnected, tabs will expand on the usefulness of existing inch-scale computers such as the pocket calculator and the pocket organizer. Tabs will also take on functions that no computer performs today.”

M. Weiser

- Petits
- Interconnectés
- Applications embarquées


ParcTab
Transceiver
IR Gateway
Ethernet
Agent
Applications
Tab 1
Tab 4
Conference Room
Bill's Office
Tab 3
Roy's Office
IR Gateway
IR Gateway
IR Gateway
Tab 1 Agent
Tab 2 Agent
Tab 3 Agent
Tab 4 Agent
SHELL
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SHELL
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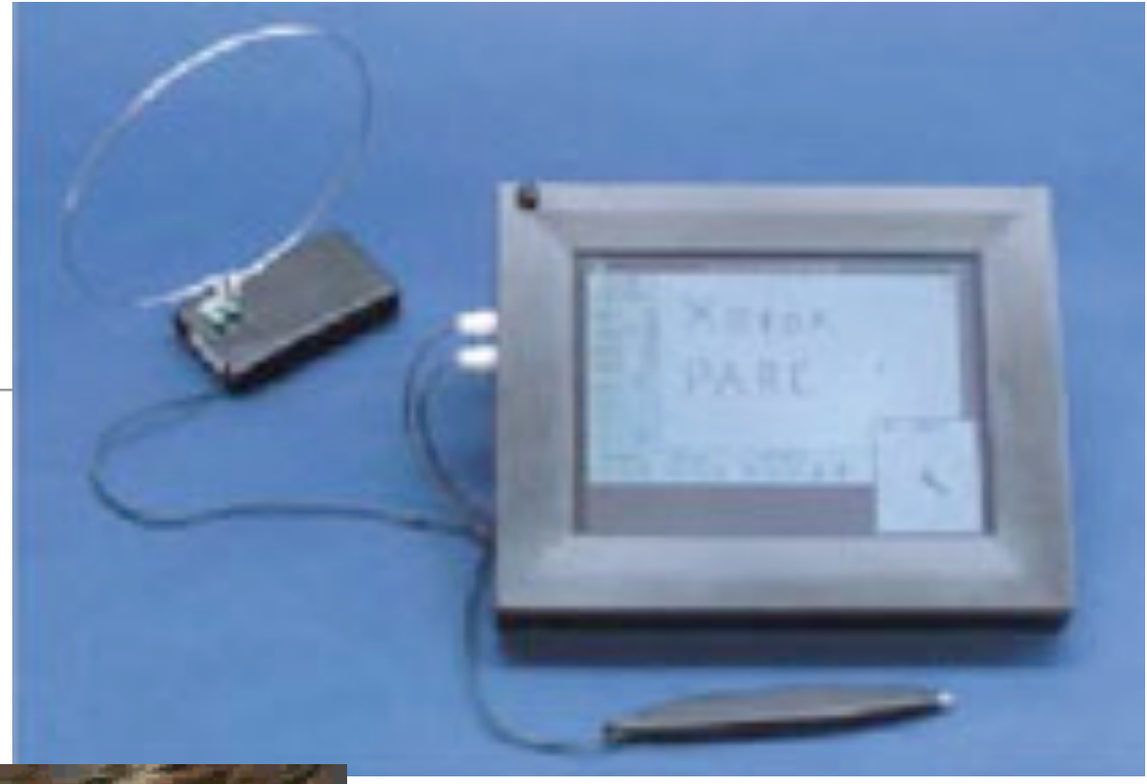
Pads



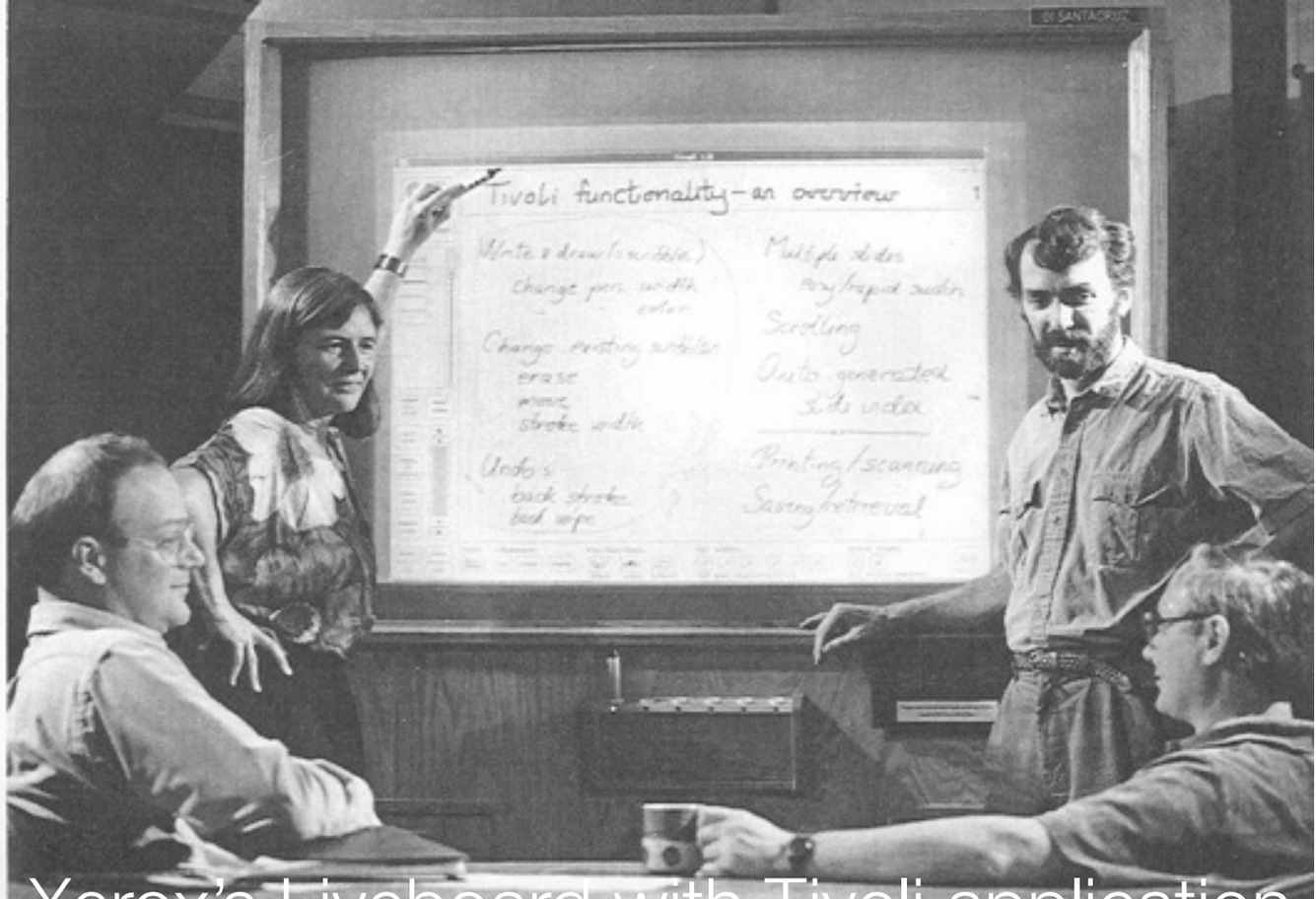
“Pads differ from conventional portable computers in one crucial way. Whereas portable computers go everywhere with their owners, the pad that must be carried from place to place is a failure. Pads are intended to be ‘scrap computers’ (analogous to scrap paper) that can be grabbed and used any-where; they have no individualized identity or importance.”

M. Weiser

Boards

“We have built enough Liveboards to permit casual use: they have been placed in ordinary conference rooms and open areas, and no one need sign up or give advance notice before using them. By building and using these boards, researchers start to experience and so understand a world in which computer interaction casually enhances every room.”

M. Weiser



Xerox’s Liveboard with Tivoli application

http://www.vaeggen.copenhagen.dk/

The Computer for the 21st Century

"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."

- l'écriture, l'eau, l'électricité…
- Embarqué, invisible, tacite, ambiant, périphérique.
- Conscient de l'environnement

Dangling Wire de Natalie Jeremijenko

Un exemple de Calm Technology

https://people.csail.mit.edu/rudolph/Teaching/weiser.pdf
https://calmtech.com/index.html

Good Night Lamp
A. Deschamps-Sonsino

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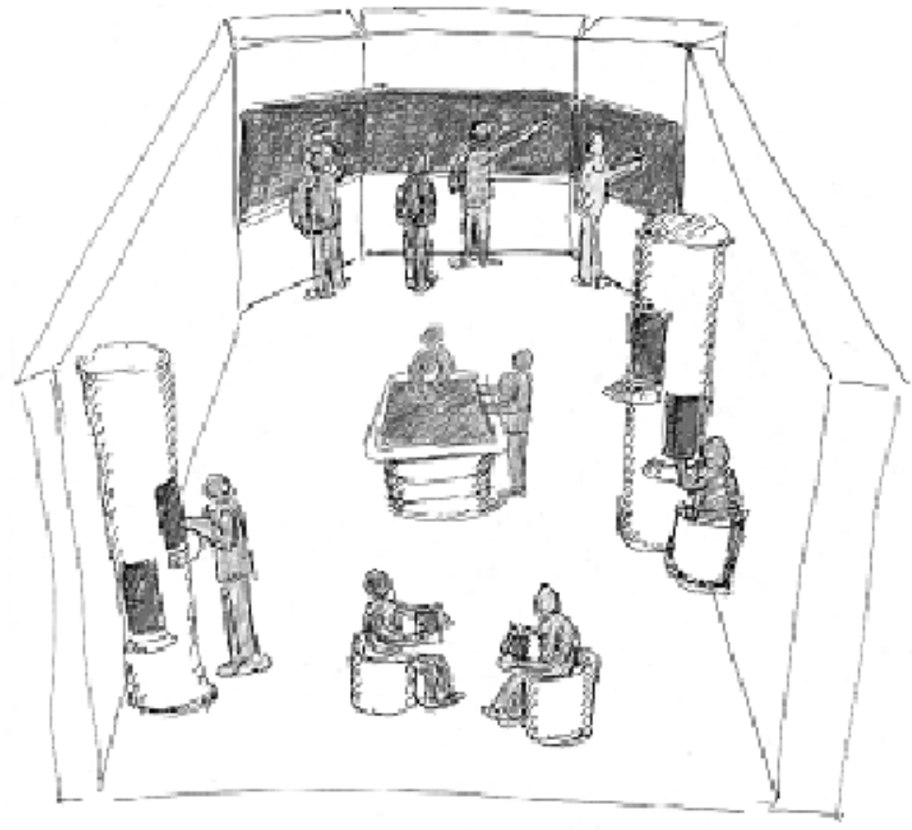
En Europe



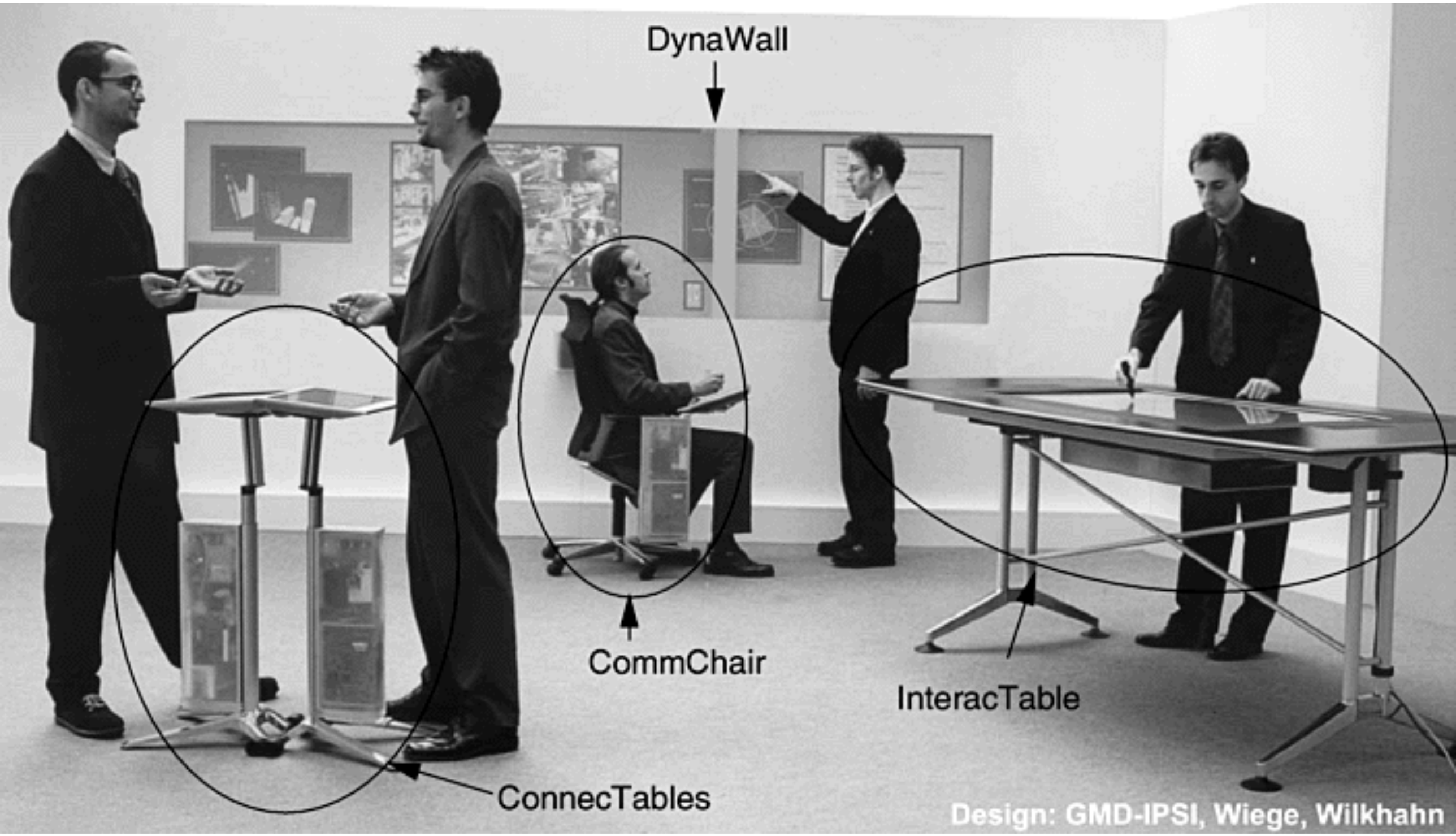
i-Land: “RoomWare” pour la créativité et

Concepts

- Intégration de l’espace architectural et informationnel.
- Nouvelles pratiques de travail.

Scénarios

- Rencontre dans le couloir, dessin sur le mur
- Travail collaboratif en sous-groupe —> session de discussion


DynaWall
CommChair
InteracTable
ConnecTables
Design: GMD-IPSI, Wiege, Wilkhahn

i-Land

DynaWall

- Mur interactif tactile : 4,5m x 1,1m

CommChair

- Chaises avec ordinateur et station de docking intégrées pour portables

InteracTable

- Table interactive tactile : 65x85cm

Passage

- Mécanisme de passage d’information et d’association entre objets physiques et numériques.

Infrastructure

Integration

- De tous les composants hardware
- Réseau + infrastructure logicielle
- “OS for RoomWare”

Software Infrastructure ~ BEACH

- Partage d’information
- Gestion d’interfaces distribuées
- Distribution, réplication, gestion d’objet informationels

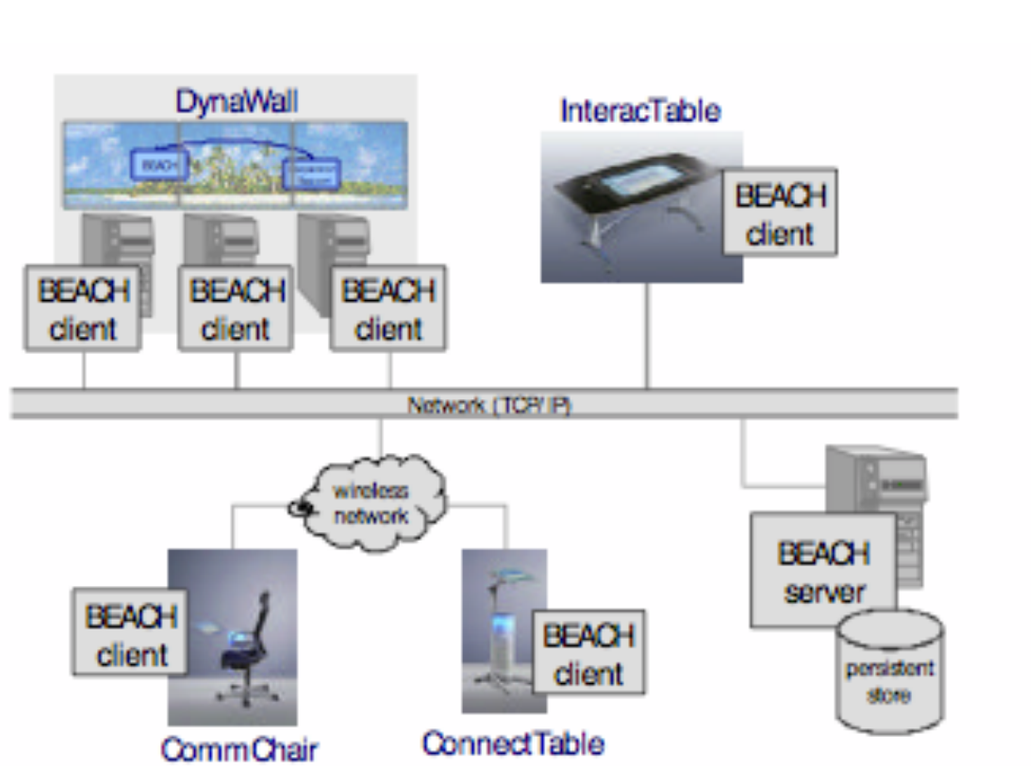


Fig. 4. BEACH clients running on different roomware component are synchronised by a server

https://www.youtube.com/watch?v=u3l139Txuk4

Vision of the future (Philips, 1996)

L’informatique Ubiquitaire

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- **Aujourd’hui**

Principes et examples

Décentralisation

- Nombreux dispositifs
- Distribués, mobiles, p2p

Diversifiés

- Universel -> dédié
- Grand nombre de clients

Connectivité

- Toujours actif
- Sans fil

Simple

- “Information appliances”, dédiées avec fonctionnalité limitées
- “Intelligent”

→ Context-awareness

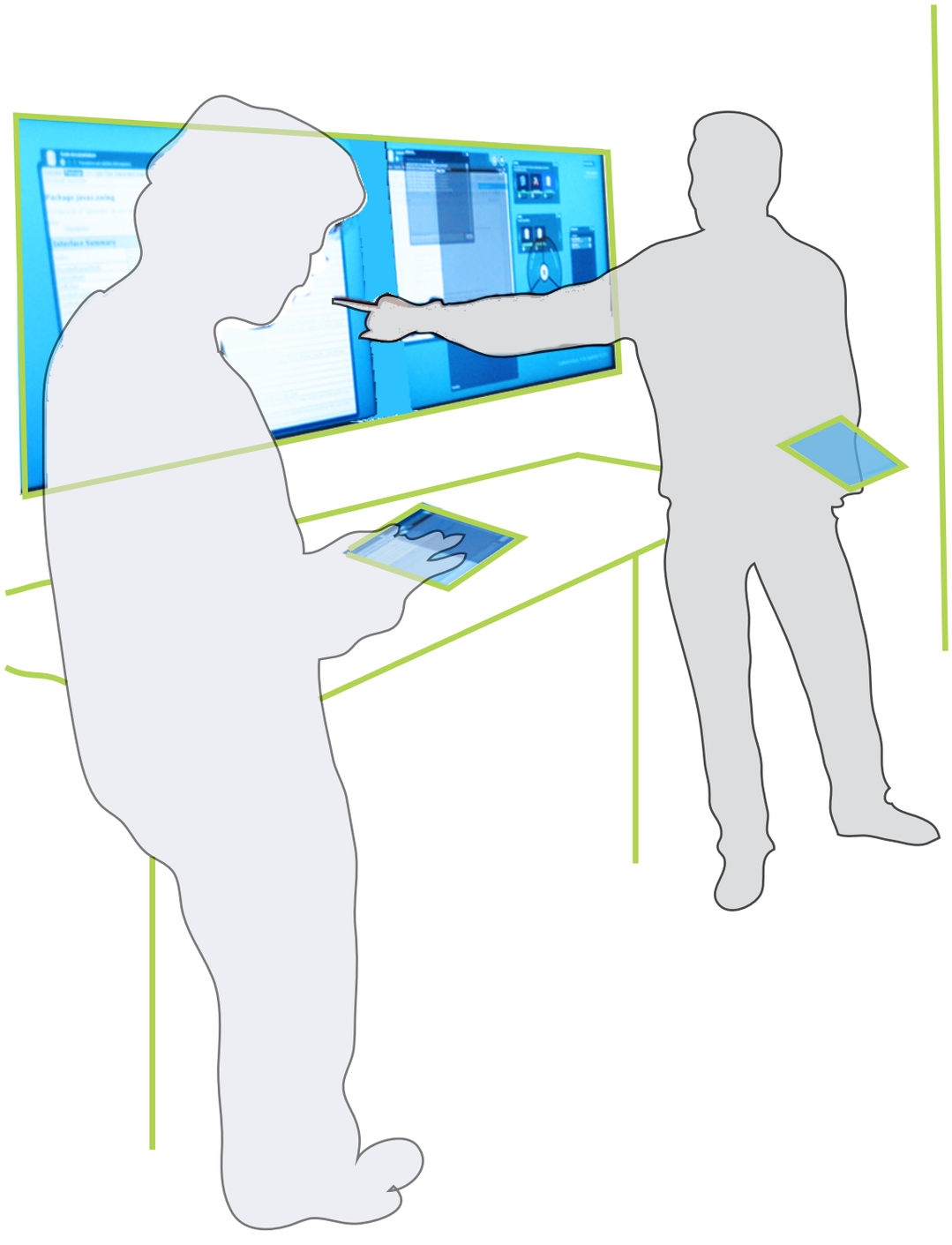
→ Activity-awarenes

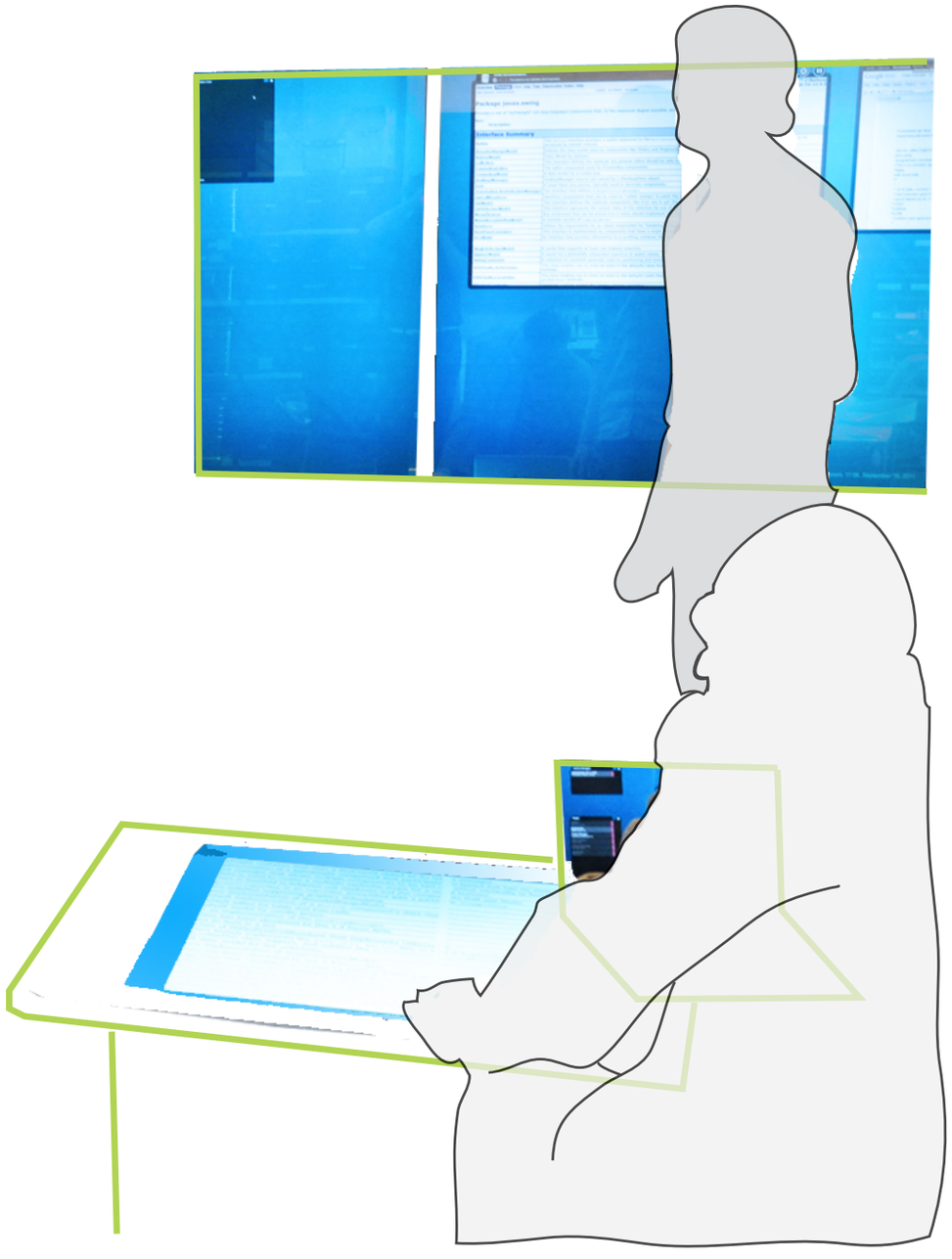
Une personne, de nombreux dispositifs

Un dispositif, de nombreux utilisateurs

Smart-home

Smart spaces



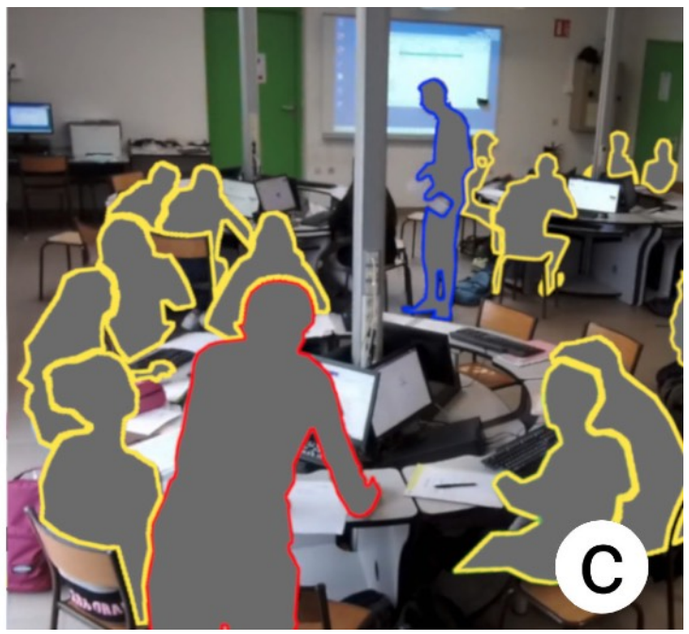


Mobilité


Заднее табло
Датчики задымления и температуры в салоне
Три видеокамеры
Табло «бегущая строка»
Датчики учета пассажиропотока
Боковое табло
Контроллер датчиков пассажиропотока
НИС ГЛОНАСС
БЕЗОПАСНЫЙ АВТОБУС
ГЛОНАСС

Santé et soins

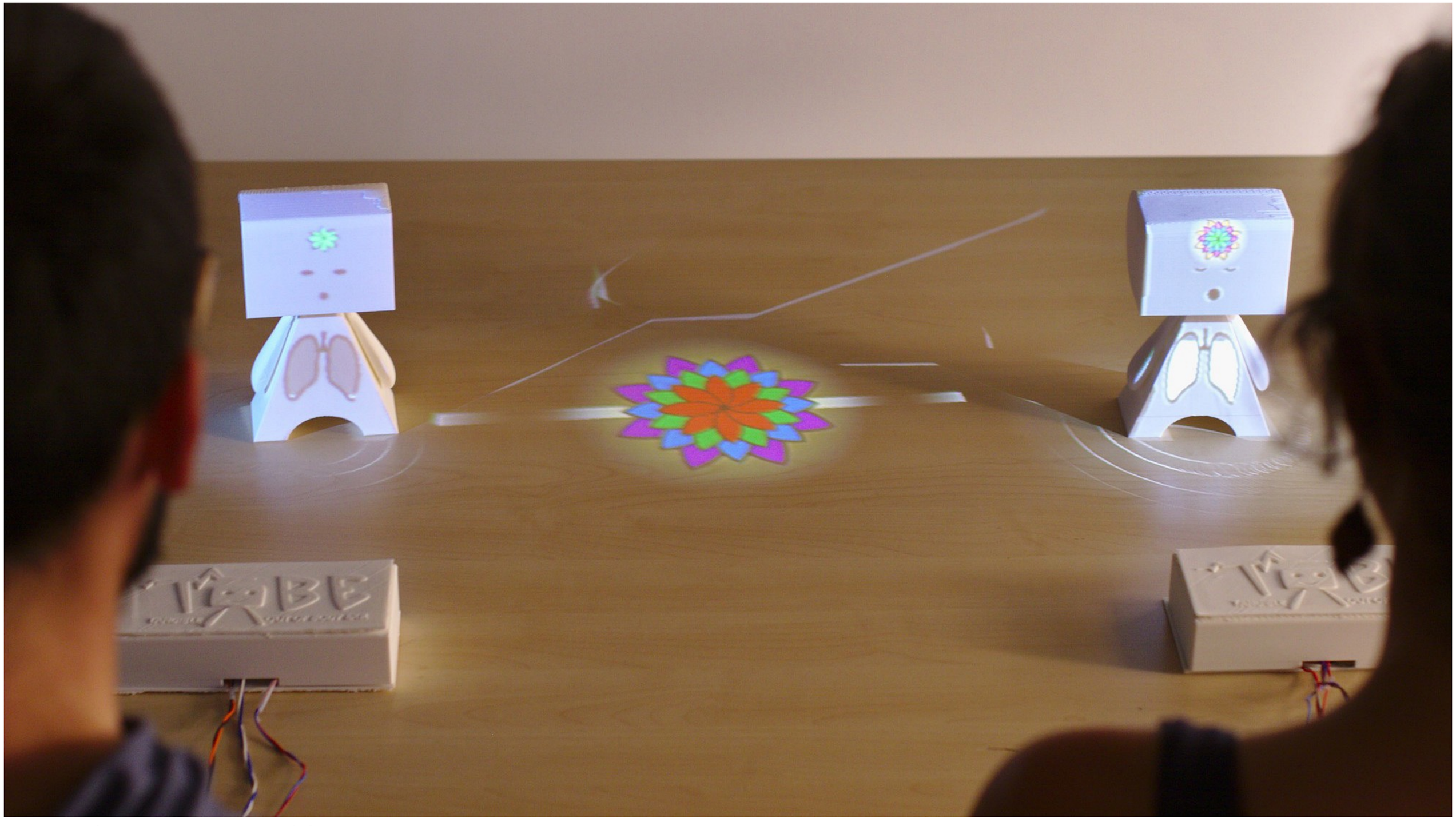
Education



Wearables

Informatique tangible

Réalité mixte

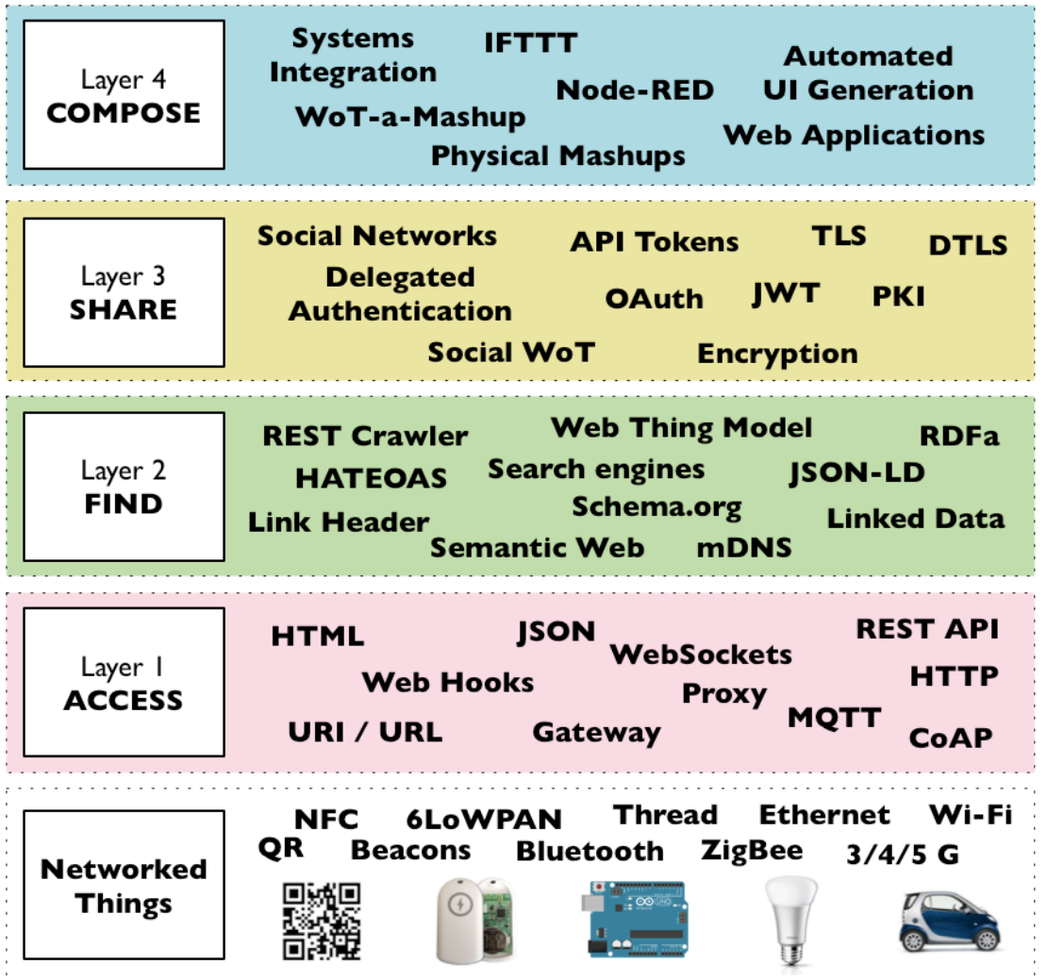


Web of Things

https://www.w3.org/WoT/

Couche Web sur l'Internet of Things

- Un GT du W3C
  2 Candidate Recommendations
- Réutiliser les standards
- Simplifier la création de services
- Des bases anciennes
  Projet Cooltown de HP en 2002
- Des entreprises actives:
  xively, evrythng, …



Source: Building the Web of Things: book.webofthings.io
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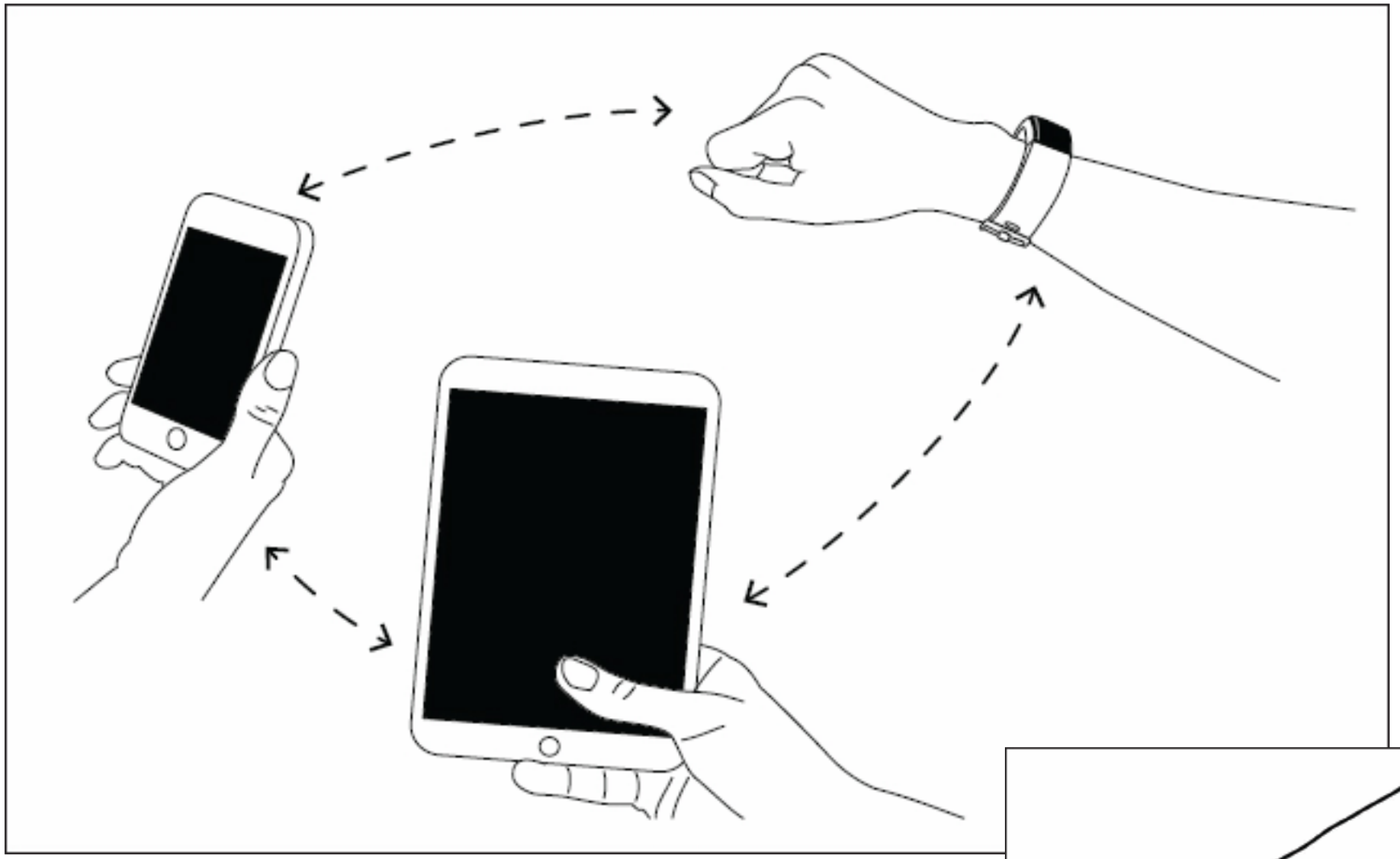
Bilan

1. Concevoir pour la présence quasi-continue du numérique
2. Présenter l'information en respectant l'attention des utilisateurs -> de la périphérie vers le focus
3. Lier mondes physique et numérique
4. Transformer nos méthodes de conception, pour imaginer répondre à des besoins diffus et difficilement formalisables
5. Enjeux en termes de vie privée et environnemental

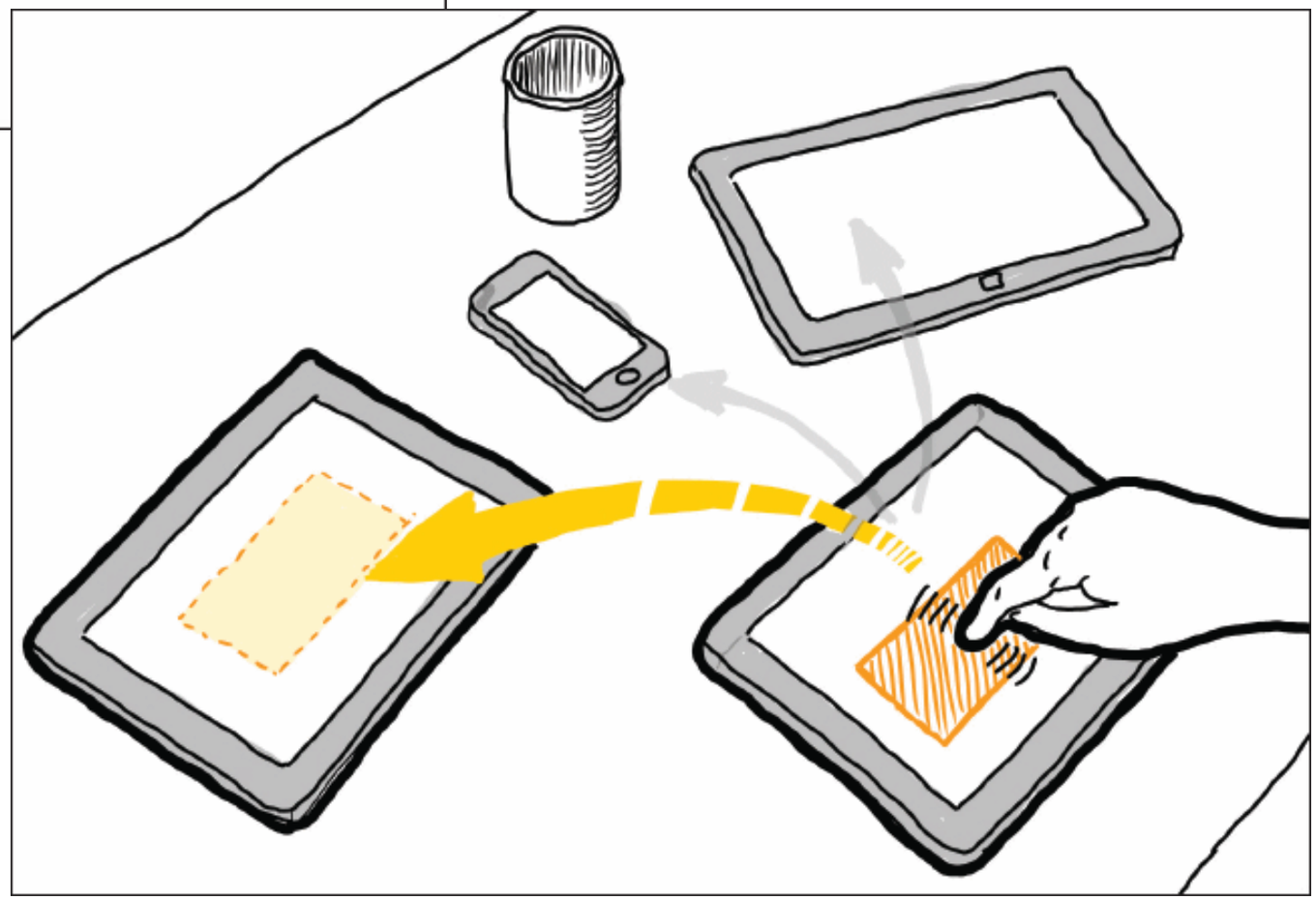
Plan

- L’informatique Ubiquitaire
- **Design Adaptatif**
- Reconnaissance de Gestes



sketch by Lindsay MacDonald Vermeulen

sketch by Nicolai Marquardt



Design Adaptatif

- **Responsive Design: rappels et limites**
- Interfaces plastiques, design adaptatif
- Interaction inter-dispositif (cross-device)

Design Responsif

Adaptation au dispositif d'affichage en s'appuyant sur :

- des tailles relatives : % ou em plutôt que px ou cm
  - pour les images,
  - pour les fonts,
  - pour les div,
- avec des limites min/max
- des vecteurs / glyphicon (-> relatif plutôt qu'absolu)
- des grilles fluides via des media queries
  - Des règles CSS différentes selon le dispositif
  - Souvent la largeur (width) de l'écran ou de la fenêtre.

Les limites

Adaptation uniquement du côté affichage

- Pas du côté de l'entrée (touch vs. souris)

Pas de réflexion sur les usages

- Différents selon le dispositif : au bureau ou dans les transports

Centré sur un dispositif

- Ne pense pas l'orchestration de plusieurs dispositifs

Plan

- Responsive Design: rappels et limites
- **Design adaptatif, Interfaces plastiques**
- Interaction inter-dispositif (cross-device)

Design adaptatif

Idée générale :

Une “application” optimisée pour chaque dispositif.

Question :

Comment adapter efficacement ?

Interfaces plastiques

http://iihm.imag.fr/publs/2012/LivreAmi-Chap9-Plasticite-CoutazCalvary_.pdf

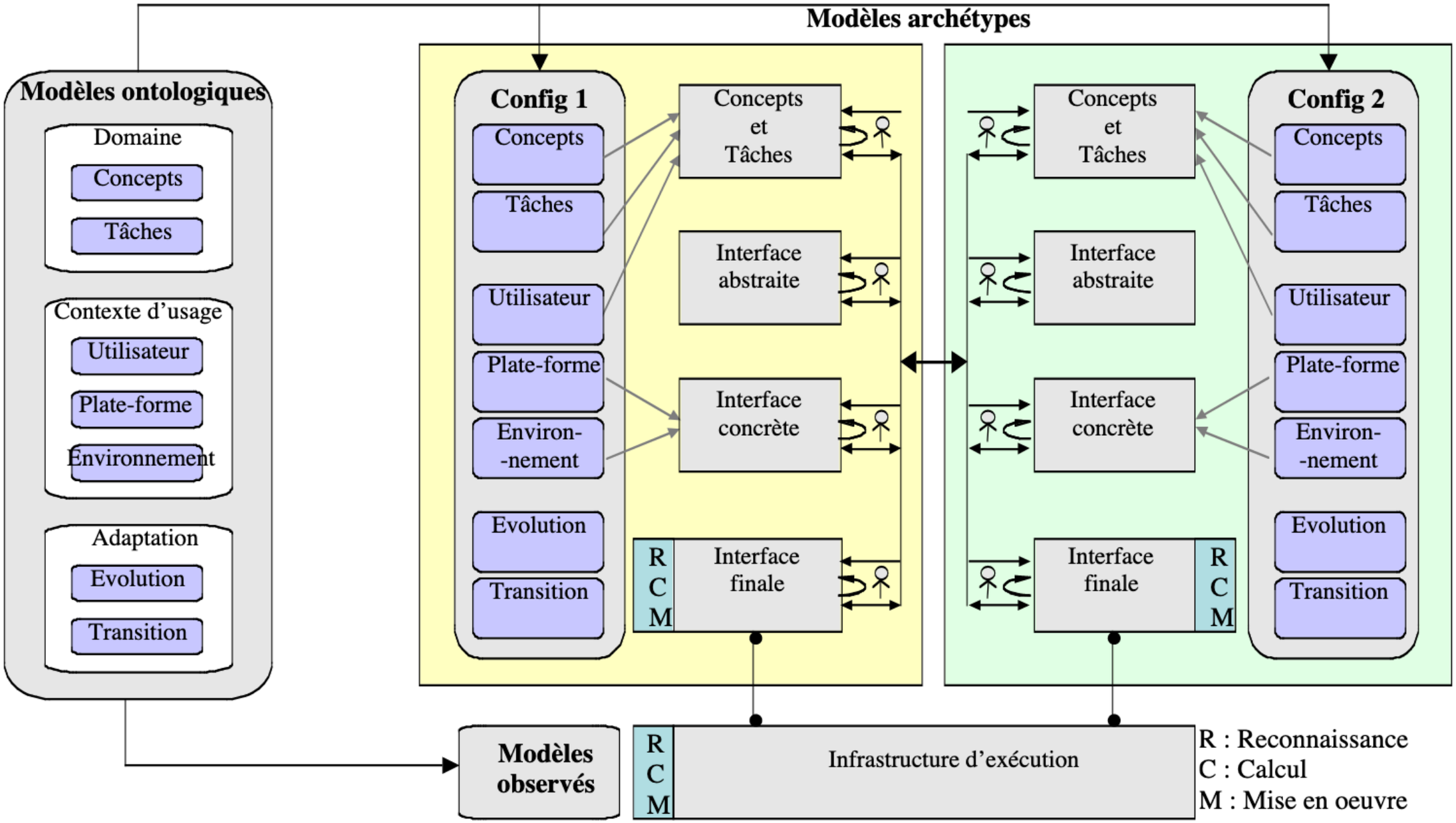
"La plasticité de l'interface homme-machine d'un système interactif dénote la capacité d'adaptation de cette interface au contexte d'usage pour en préserver l'utilité et l'utilisabilité et, par extension, la valeur tout en accordant à l'utilisateur les moyens de contrôle adéquats." *Coutaz et al. '12*

Principes:

- UI remodelage (Suppression, Insertion, Substitution, Réorganisation)
- UI Redistribution (niveau Application, espace de travail, interacteur, pixel)
- Maintien l'état (système, tâche, action)
- Meta-UI (avec ou sans negociation)

Un méta-modèle

http://iihm.imag.fr/publs/2012/LivreAmi-Chap9-Plasticite-CoutazCalvary_.pdf



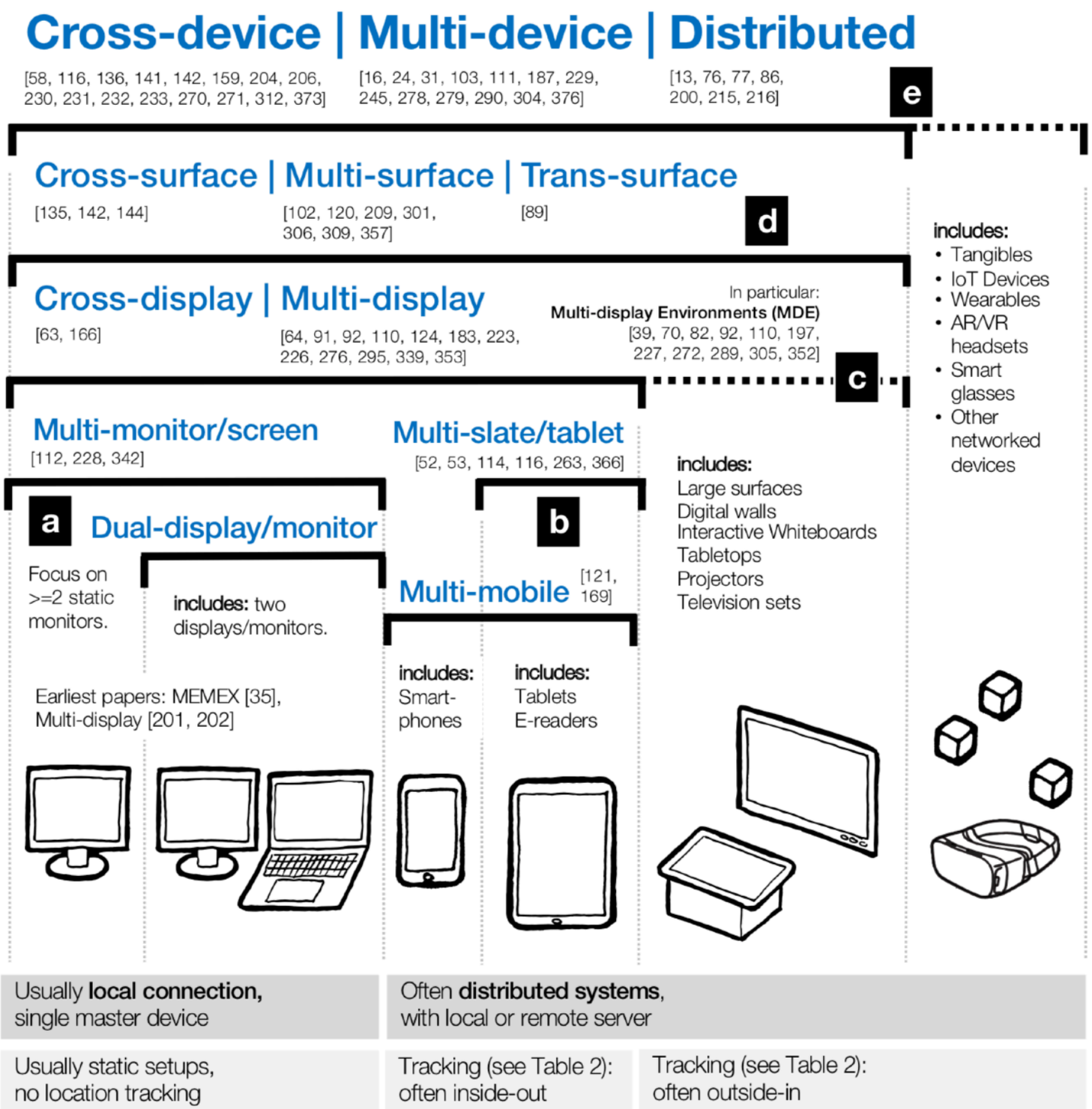
Plan

- Responsive Design: rappels et limites
- Interfaces plastiques, design adaptatif
- **Interaction inter-dispositif (cross-device)**

Pick and Drop – Rekimoto ‘97

https://www.christianholz.net/2019-chi19-brudy_holz_raedle_wu_houben_klokmose_marquardt-Cross-Device_Taxonomy-Survey_Opportunities_and_Challenges_of_Interactions_Spanning_Across_Multiple_Devices.pdf

Les types d'interaction cross-device



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Les éléments à considérer

1 Temporal

Synchronous (Simultaneous use)

Related taxonomies and surveys: [86, 111, 142, 229, 256, 276, 292, 330]

Mirrored

Description: *mirroring the exact same content on multiple screens/displays.*

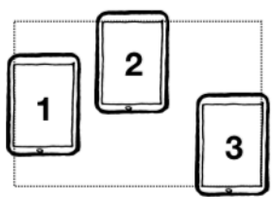
Key terms:
- Cloned [276]
- Screen casting [214, 240]
- Screen sharing [302]
- Mirroring [213, 214]

Distributed UI

Spatial distribution

Description: *spatial distribution of the continuous visible area of one screen across a number of devices.*

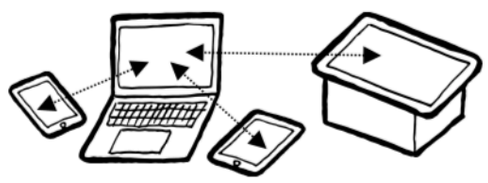
Related taxonomies: [276, 292, 330]
Key terms:
- Extended, connected screens [109, 192, 276, 297]
- Annexing [127, 373]
- Display Contiguity [276]
- Spatial awareness; peephole navigation [90, 193, 270]
- Perspective aware UI [226, 227]
- Stitching views [7]



Logical distribution

Description: *logical distribution of distinct UIs or elements across a number of devices.*

Related taxonomy: [86]
Key terms:
- Distributed, seamless, continuous UI [64, 143, 174, 271]
- Multiple coordinated/synchronized views [91, 263, 276, 322]
- Federated UI [52, 206]
- Divisible UI [154]
- Interface beaming [141, 227]
- Joint Interactions [28, 54]
- Extending application's UI [261]



Second screen

Description: *focus on TV + device*

Related taxonomy: [229]
Key terms:
- Second screen [1, 85]
- Companion app [84, 85]
- Cross-media [229]
- Actual use [132]

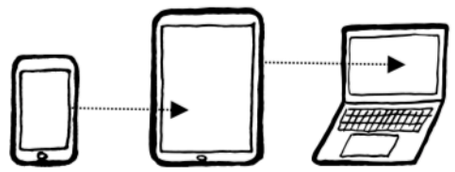
Asynchronous (Sequential use)

Related taxonomies and surveys: [76, 86]

Migratory interfaces

Description: *adaptive interfaces that are capable to migrate between multiple devices (in particular, different form factors).*

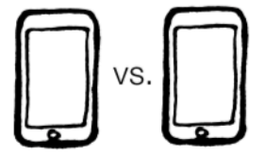
Related taxonomy: Reference model [76]
Key terms:
- Migratory interfaces [19, 20]
- Application migration [100, 341]
- Adaptive interfaces [257]
- Model-based approach [200]
- Component migration [101]
- Continuity [273, 318]
- Plasticity [76, 86]
- Multi-target interfaces [86]
- Device shifting [56]



Cross-platform

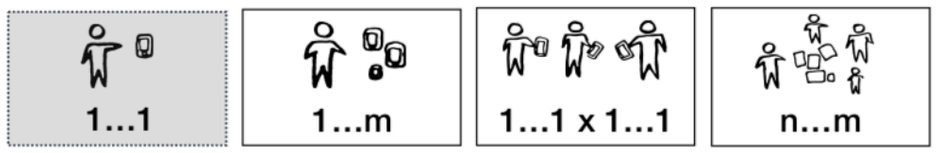
Description: *development of interfaces that run on different device form factors and operating system platforms.*

Key terms:
- Cross-platform, multi-platform, cross-modal [221, 248, 336]
- Adaptive interfaces [21]
- Consistency across devices [221]
- Liquid software [95, 96]

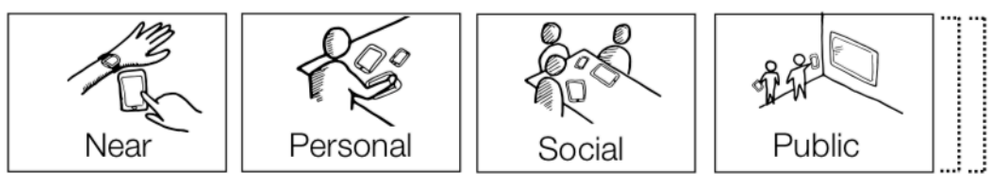


2 Configuration

3 Relationship

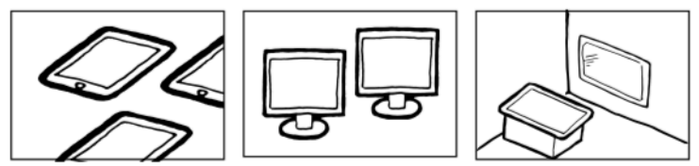


4 Scale



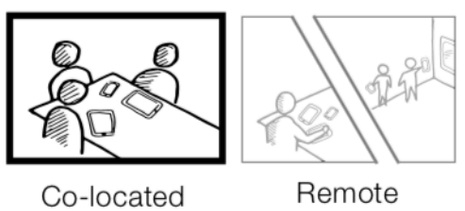
Related to:
- Device/space taxonomy [330]
- Hall's proxemic zones [115]
- Tab/Pad/Yard [355]

5 Dynamics



And: possible fluid transitions between (hybrid)

6 Space



Majority of cross-device research is in co-located spaces.

Examples: [13, 174]

https://www.christianholz.net/2019-chi19-brudy_holz_raedle_wu_houben_klokmose_marquardt-Cross-Device_Taxonomy-Survey_Opportunities_and_Challenges_of_Interactions_Spanning_Across_Multiple_Devices.pdf

Les phases à gérer

Phase 1

Configuration

Setting up cross-device configurations of devices including pairing, combining, connecting devices.

Phase 2

Content Engagement

Techniques aimed at interacting with, transferring or exploring content, data, visualisations, or interfaces that spread across multiple devices.

Phase 3

Disengagement

Techniques to disconnect cross-device setups or configurations, interactions and applications.

Apple Continuity

https://support.apple.com/en-us/HT204681

Handoff: Start work on one device, then switch to another nearby device and pick up where you left off.

Universal Clipboard: Copy content such as text, images, photos, and videos on one Apple device, then paste the content on another Apple device.

iPhone Cellular Calls: Make and receive calls from your Mac, iPad, or iPod touch when those devices are on the same network as your iPhone.

Text Message Forwarding: Send and receive SMS and MMS messages from your iPhone on your Mac, iPad, and iPod touch.

Instant Hotspot: Connect to the Personal Hotspot on your iPhone or iPad (Wi-Fi + Cellular) from your Mac, iPad, iPod touch, or another iPhone, without entering a password.

Auto Unlock: Get instant access to your Mac when wearing your Apple Watch, and quickly approve other requests to enter your Mac administrator password.

Continuity Camera: Use your iPhone, iPad, or iPod touch to scan documents or take a picture and have it appear instantly on your Mac.

Continuity Sketch: Create a sketch on your iPad, iPhone, or iPod touch, and easily insert it into a document on your Mac.

Continuity Markup: Use your iPad, iPhone, or iPod touch to add sketches, shapes, and other markup to a Mac document, and see the changes live on your Mac.

Sidecar: Use your iPad as a second display that extends or mirrors your Mac desktop. Or use it as a tablet input device to draw with Apple Pencil in Mac apps.

AirDrop: Wirelessly send documents, photos, videos, websites, map locations, and more to a nearby iPhone, iPad, iPod touch, or Mac.

Apple Pay: Shop online on your Mac and complete your purchase using Apple Pay on your iPhone or Apple Watch.

https://www.apple.com/fr/macos/monterey/

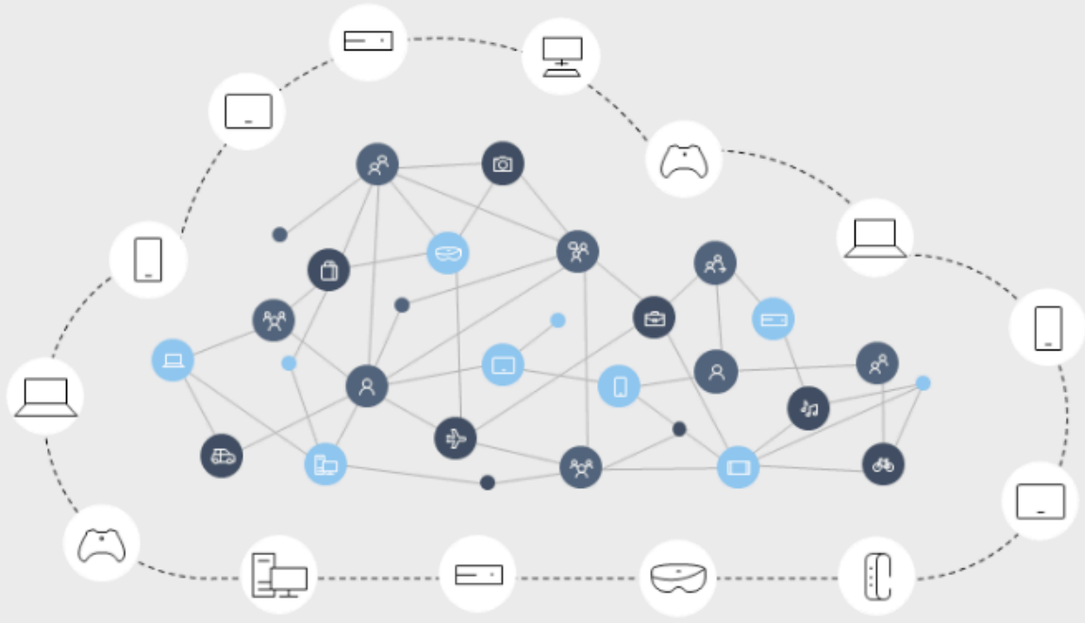
Microsoft

https://developer.microsoft.com/en-us/windows/project-rome

Project Rome

Build people centric experiences on all devices.

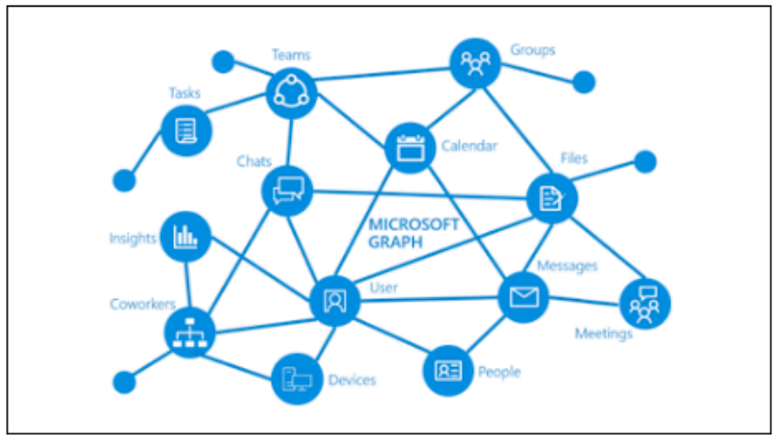
A device-independent platform for building people-centric experiences that span all devices.



Check out Graph Notifications.

Read more

Technologies

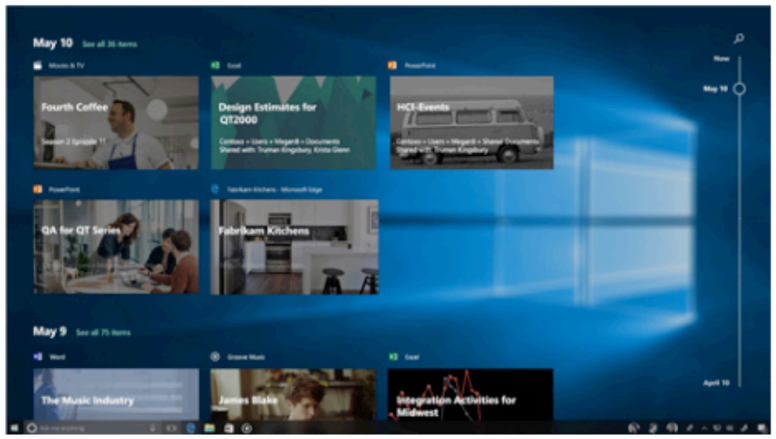


Microsoft Graph Notifications

New at Ignite 2018

Graph Notifications offers an enterprise-compliant, people-centric, and cross-platform notifications platform using the Microsoft Graph.

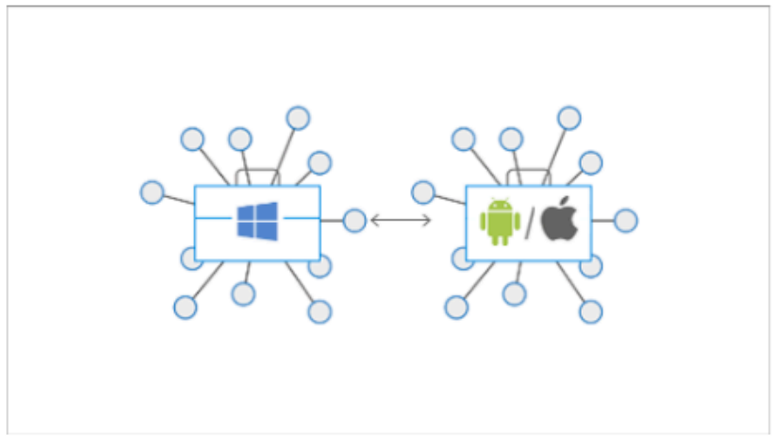
LEARN MORE >



Activities/Timeline

Activities make users more productive by helping them resume important tasks in your app quickly across devices and platforms in experiences like Windows Timeline, Cortana and Microsoft Launcher.

LEARN MORE >



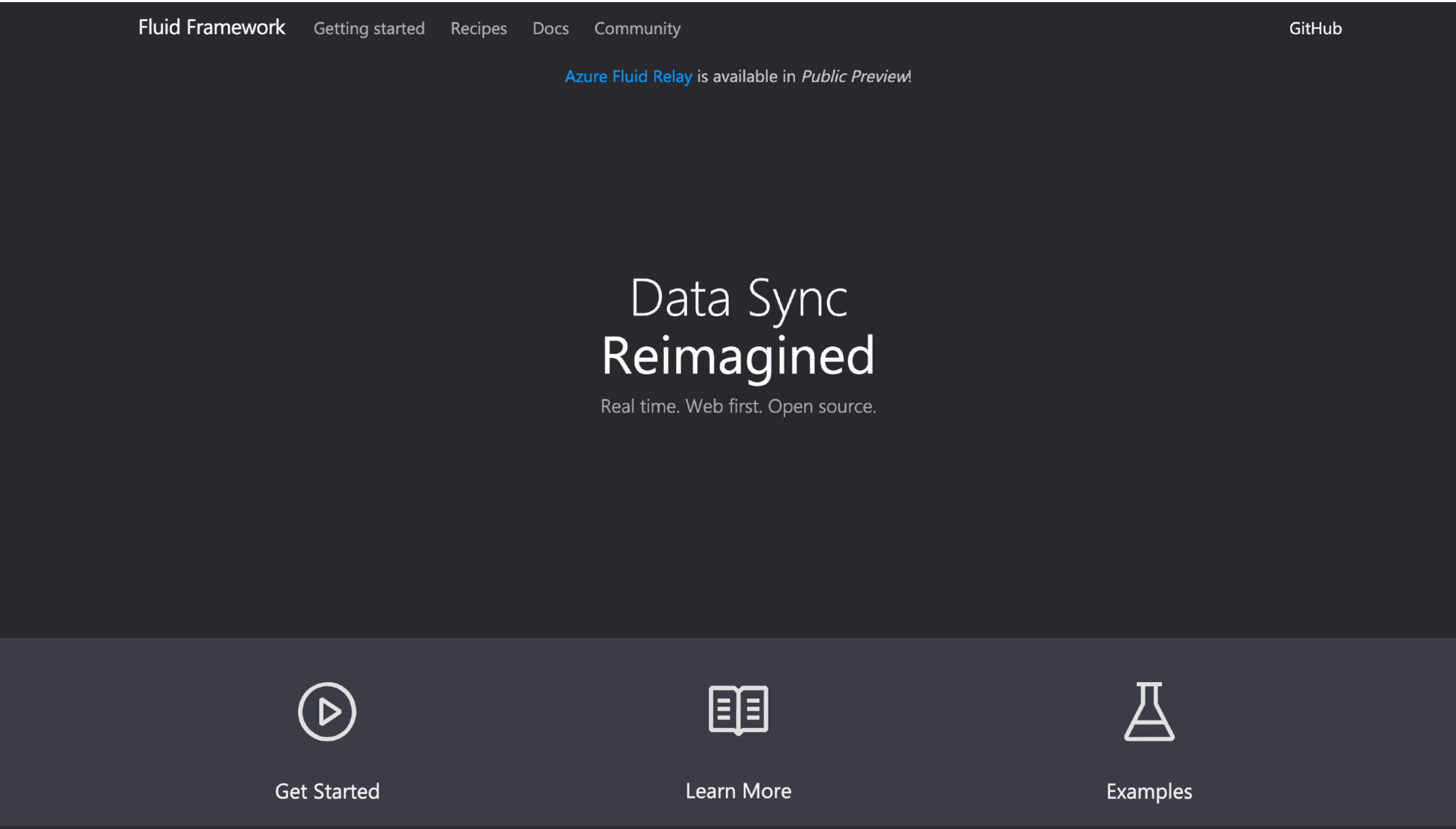
Device Relay

Users often start productivity tasks and entertainment on one device and continue them on another. You can use the device relay APIs to make these experiences seamless.

LEARN MORE >

Mais aussi MS Loop, basé sur Fluid Framework

https://www.microsoft.com/en-us/microsoft-loop



Quels outils de développement pour le Web ?

- Progressive Web Apps, que pour un dispositif.
- Manque
  - Des bibliothèques
  - D’outils de debugging
  - Des liens entre applications (traitées en silo)

Plan

- L’informatique Ubiquitaire
- Design Adaptatif
- **Interaction gestuelle**

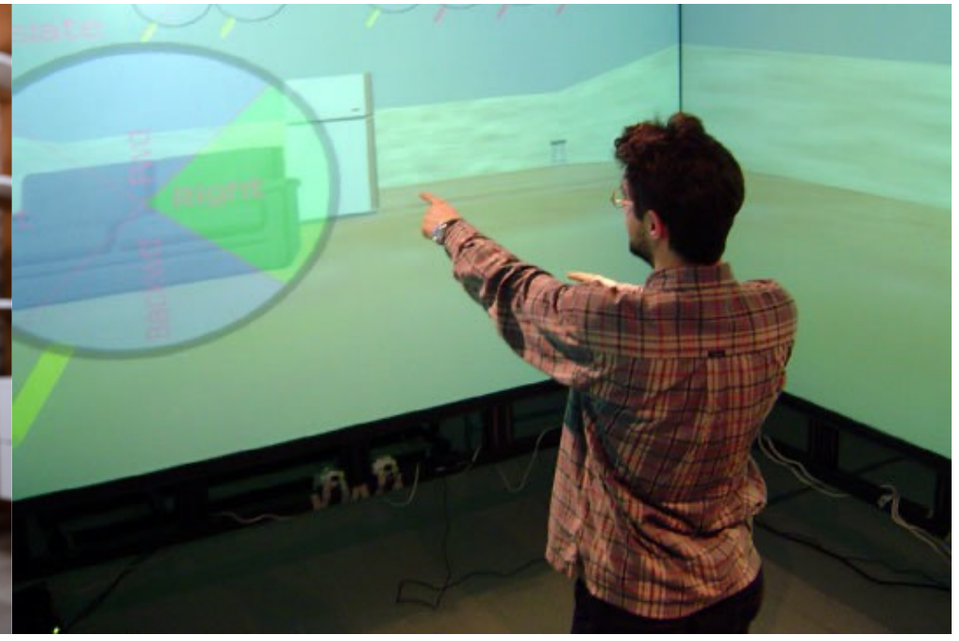
Interaction gestuelle

- Interaction gestuelle
- Rubine
- $1 Recognizer

Contexte: l'interaction post-WIMP

WIMP: Windows Icon Menu Pointer



L’interaction gestuelle

https://uxmag.com/articles/new-design-practices-for-touch-free-interactions

Deux familles d'interaction gestuelles

Interaction sur écran tactile :

- gestes 2D mono ou multi-points.

Interaction libre (free-form) :

- peu de contraintes directes
- Utilisation d'un contrôleur et/ou du corps

Qu'est qu'un geste

"A gesture is a form of ***non-verbal communication*** or non-vocal communication in which ***visible bodily actions*** communicate ***particular messages***, either in place of, or in conjunction with, speech. Gestures include ***movement of the hands, face, or other parts of the body***. Gestures differ from physical non-verbal communication that does not communicate specific messages, such as purely expressive displays, proxemics, or displays of joint attention."

A. Kendon, *Gesture: Visible Action as Utterance*, Cambridge University Press, 2004

Propriétés des gestes

1. Statique (posture) ou dynamique (mouvement)
2. Définit spatialement et temporellement
3. Transmet de l’information
4. Délibéré

Les fonctions du geste de Cadoz (1994)

Gestes sémiotiques : communique de l'information à l'environnement. Ex: gestes qui accompagne le langage, langue des signes, de chefs d'orchestres…

Gestes ergotiques : transforme physiquement l'environnement (la matière) pour la former, la transporter la casser…

Gestes épistémiques : pour apprendre de l'environnement à travers une exploration tactile et haptique.

Les gestes sémiotiques (nous intéressent)

Une sous-classification:

- Gestes symboliques, spécifiques à une culture (ex: 👌), seuls à pouvoir être interprétés sans besoin de contexte.
- Gestures déictiques, ex: pointage
- Gestes iconiques, pour transmettre des informations sur la taille, la forme ou l'orientation d'un objet du discours. (ex: mouvement vers le bas)
- Gestures pantomimes, qui mime le mouvement d'un objet tel qu'utilisé (ex: j'ai tourné le volant comme ça).

5 questions en interaction gestuelle

- Comment les utilisateurs s'adressent au système ?
- Comment le système établit qu'il est prêt à recevoir une entrée?
- Qu'est ce que le système peut faire ?
- Comment le système répond ?
- Comment le système permet d'éviter ou de réparer une erreur ?

Définir un vocabulaire de gestes

- Comprendre le contexte
- Choisir le type d'interaction
- Définir le vocabulaire de gestes, et les commandes associées
- Implémenter le système de reconnaissance
- Définir des moyens d'apprentissage / de guidage
- Évaluer la qualité en terme de reconnaissance, de compréhension, d'efficacité, de mémorisation, …

Type d’interaction gestuelle

Directe

Distance

Autour

Intégré

Plan

- Interaction gestuelle
- Rubine
- $1 Recognizer

Les approches de reconnaissance

Basé sur des templates (modèles): on aligne et calcule une une distance, pour comparer le geste en entrée à des modèles pré-enregistrés.

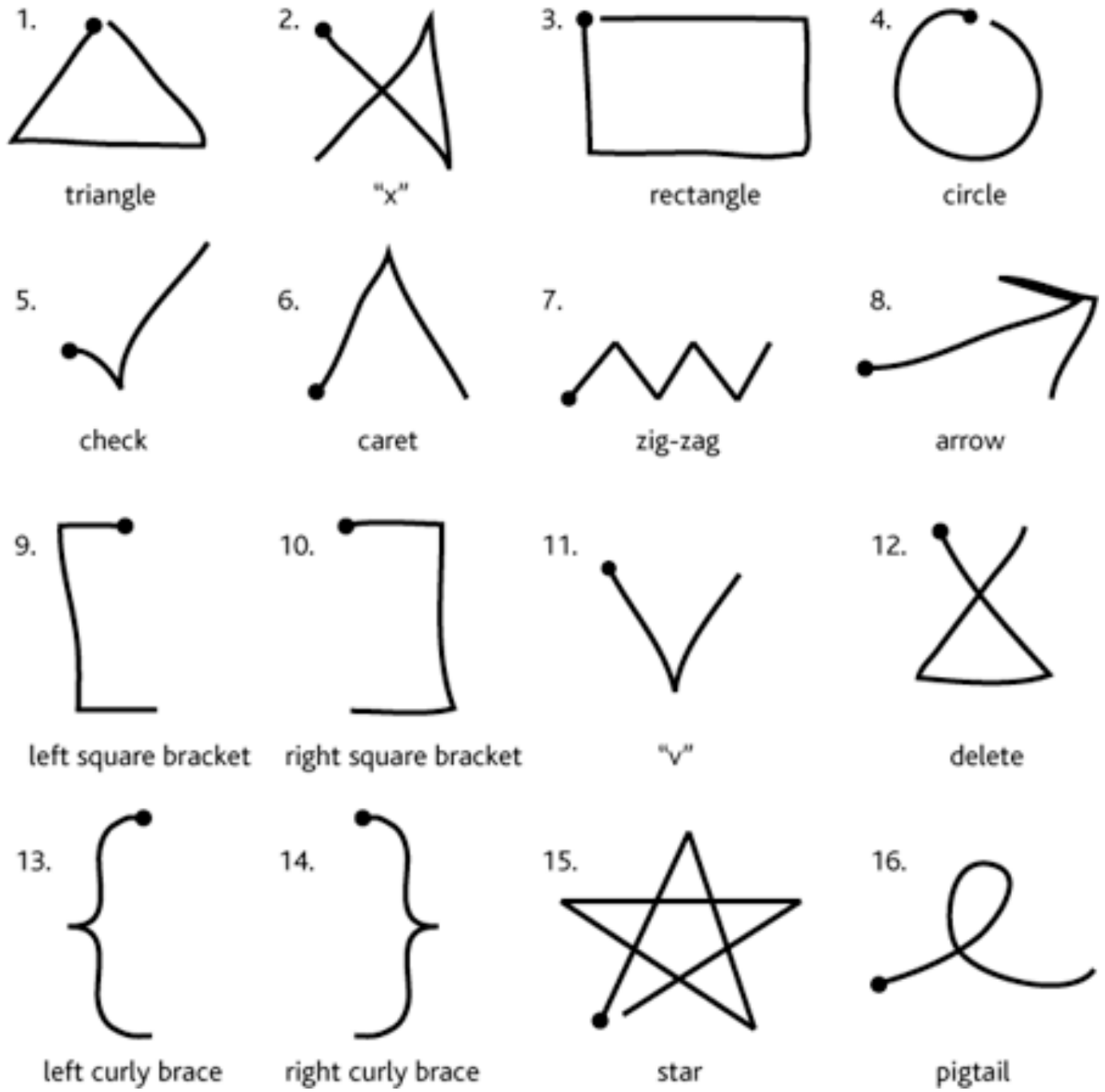
- Rubine, 1991
- $1, Wobbrock et al., 2007

Approches par Machine Learning: on apprend sur un jeu d'entrainement. Puis on calcule l'appartenance du geste en entrée aux classes de gestes apprises.

- kNN - HMM - SVM - ANN

Gestes discrets et continus: unistroke

Gestes réalisés
“d’un seul trait”



Plan

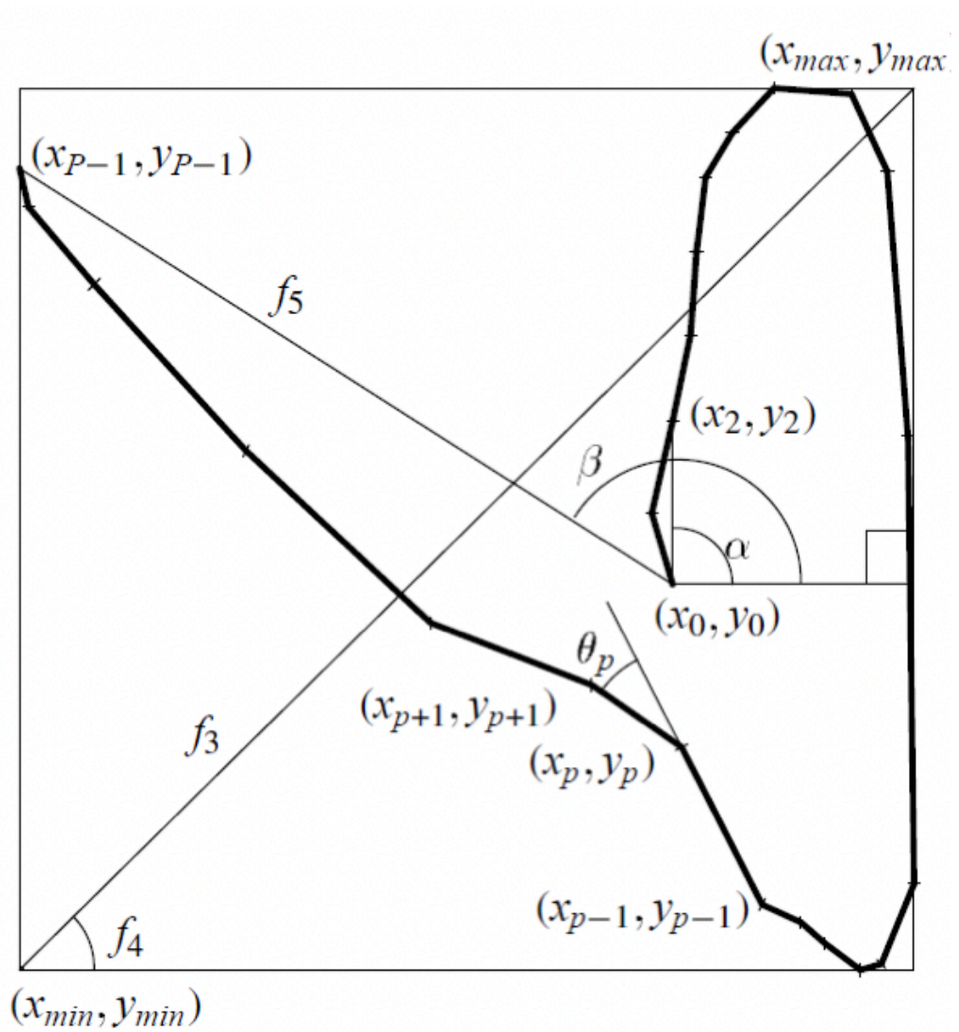
- Interaction gestuelle
- **Rubine**
- $1 Recognizer

Rubine

Les étapes :

1. L'utilisateur effectue un geste
2. Le geste est capturé sous forme d'une liste de points
3. On calcule un vecteur de propriétés (features)
4. On compare le vecteur à ceux des modèles (templates)
5. The geste reconnu est celui avec le score le plus haut

Les features



F1 cos of the gesture's initial angle
F2 sin of the gesture's initial angle
F3 length of the bounding box diagonal
F4 angle of the bounding box diagonal
F5 distance between the first and the last point
F6 cos of the angle between the first and the last point
F7 sin of the angle between the first and the last point
F8 total gesture length
F9 total angle traversed
F10 sum of the absolute value of the angle at each point
F11 sum of the squared value of those angles
F12 maximum speed of the gesture
F13 duration of the gesture

Entrainement / Classification

http://reports-archive.adm.cs.cmu.edu/anon/itc/CMU-ITC-099.pdf

Phase d'entrainement

Reconnaissance / classification phase

$$v_{\hat{c}} = w_{\hat{c}0} + \sum_{i=1}^{F} w_{\hat{c}i} f_i$$

+ Critères de rejet

Plan

- Interaction gestuelle
- Rubine
- **$1 Recognizer**

$1 recognizer

Marche pour l’unistroke, mais nombreuses extensions pour d’autres types de gestes

Reconnaissance invariante selon

- La rotation
- L’échelle
- La position

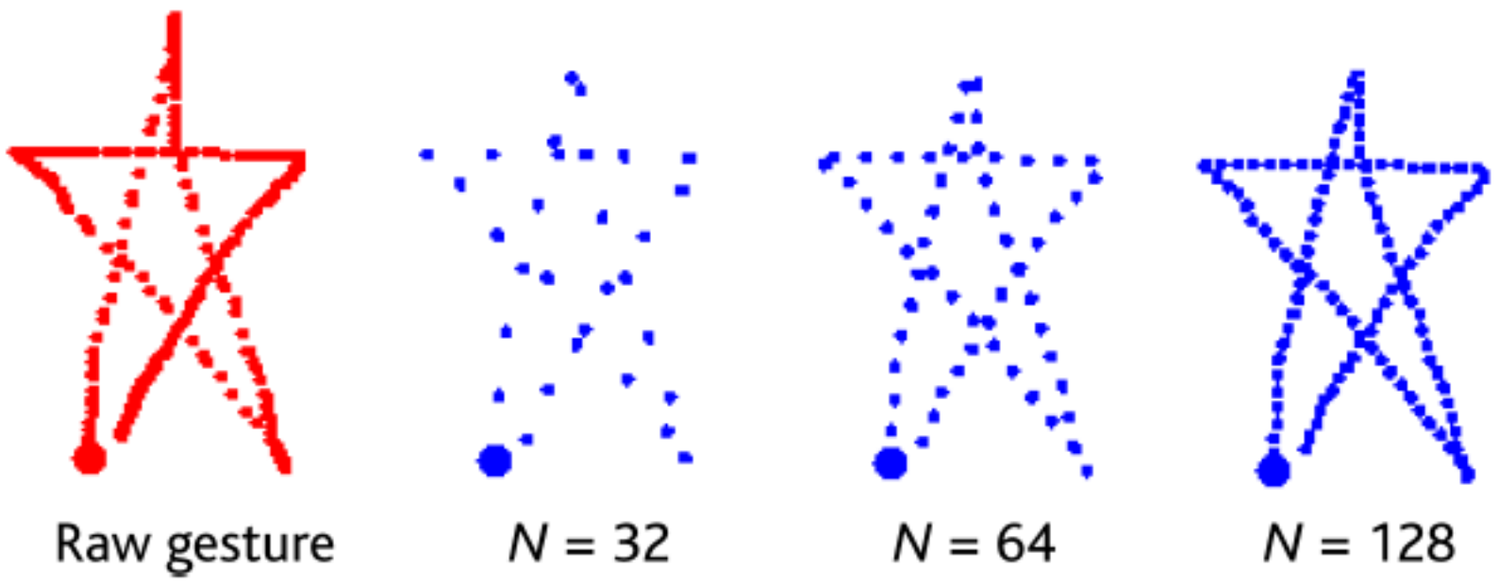
$1 Les étapes

1. Creation de templates
2. Capture du geste
3. Ré-échantillonage
4. Comparaison à des templates invariant

Ré-échantillonage

On ré-échantillonne le geste capturé pour avoir N points équidistants (généralement N=64)

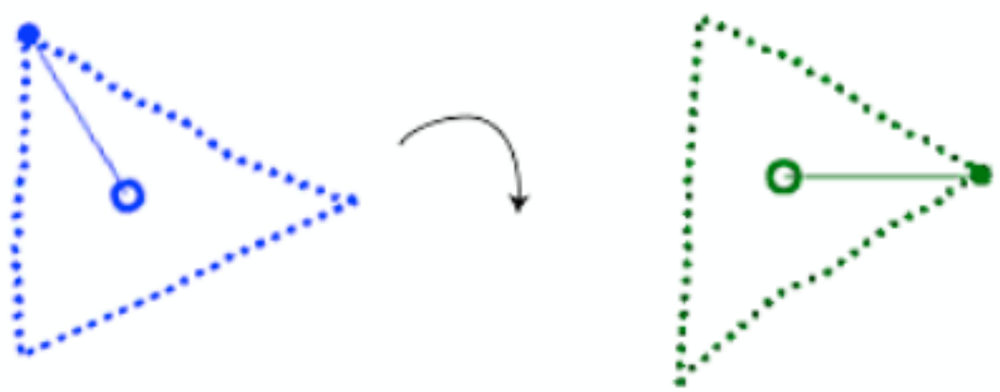
- Measure la longueur L du chemin de M points initiaux
- On calcule l'increment I = L/(N-1)
- On rajoute un point (coordonnées calculées par régression linéaire) si la distance entre deux points du signal initial est > I



Alignement angulaire

On “tourne” le geste selon son “angle indicatif”, en cherchant l’espace des angles permettant un meilleur alignement des points

- Calcul du centroid du geste
- Calcul de l’angle entre le 1e point de la trajectoire, le centroide et la ligne d’horizon.
- Rotation des points selon cet angle



Mise à l’échelle

Le geste est passé à l’échelle d’un carré de référence (non-uniforme). Après le passage à l’échelle le geste est translaté vers un point de référence (le centroide est positionné en (0,0))

- Calcul de la bounding box (x_min, x_max, y_min, y_max) -
- Passage à l’échelle du carré de référence (à la taille prédéfinie)
- Translation du centroid vers (0,0)

Reconnaissance

Le geste C est comparé à chaque Template de geste Ti

- Calcul de distance di entre C et Ti pour chaque partie du chemin. Le template avec la distance la plus faible à C est le résultat.

$$d_i = \frac{\sum_{k=1}^{N} \sqrt{\left(C[k]_x - T_i[k]_x\right)^2 + \left(C[k]_y - T_i[k]_y\right)^2}}{N}$$

- Di est converti sur une échelle [0,1].

$$score = 1 - \frac{d_i^*}{\frac{1}{2}\sqrt{size^2 + size^2}}$$

Avantages et limites du $1 recognizer

Avantages:

- Facile à comprendre
- Facile à implémenter, léger, rapide.
- “Apprend” sur un seul geste
- Résilient aux variations de vitesse et d’échantillonage
- Résilient aux variations d’orientation et d’échelle

Inconvénients:

- Ne sait pas distinguer un cercle d’un carré, une ellipse d’un cercle
- Ne peut pas distinguer l’orientation d’une flèche

Bilan

- L'informatique Ubiquitaire
  - Mark Weiser et le Xerox PARC
  - En Europe : i-LAND et Phillips
  - Aujourd'hui
- Design Adaptatif
  - Responsive Design: rappels et limites
  - Interfaces plastiques, design adaptatif
  - Interaction inter-dispositif (cross-device)
- Interaction gestuelle
  - Rubine
  - $1 Recognizer