PRoF Award abstract – Call 2015

From Bath Tub to Health Hub:
Where Architecture meets Health-Care
(Patient) Empowerment through reflection: iShrine

1. Research Outline

Acronym	iShrine
Project name in English	From Bath tub to Health Hub: Where Architecture meets Health-care (Patient) Empowerment through reflection: iShrine
Pitch (1 sentence)	The patient is going to see (you) now: iShrine saves lives and contributes to solving the patient compliance conundrum though its conceptual setup as a health-care, self-care and medical data generation hub with an integrated pill dispensing device, and a fully electrified mirror touch screen, that from an architectural and infrastructural point of view seamlessly integrates into a patient's life by being the one access point for "all things you", in a world that incorporates service in health-care, democracy in medicine and safety in patient care.

Executive summary (max. 10 lines)
In health-care (hc) we often times omit the patient because we are ignorant to her real life challenges of multimorbidity and polypharmacy. It is but the patient who needs to be at the centre of all our endeavours for if she does not comply to advice and adhere to therapy, no effectiveness in medical care will be achieved. Today 1/3 of the drugs prescribed are not taken, which equals losses of 10 Billion Euros per year in DE alone. We give health-care and self-care a place in the home, a hub where it can seamlessly integrate into the client's life. This is iShrine, the fully electrified touch-screen bathroom mirror and cupboard, integrated into a network of services useful for consumers and patients alike. iShrine is a health-care cockpit and safety belt, individual drug dispenser, data generator and marketing channel. It makes actual hc more and easier accessible, readily available, more affordable and less stigmatizing. It will provide to the age of patient enlightenment and democratisation in medicine. The main business asset is the service infrastructure and the new ecosystems around iShrine such as direct up-links to medical professionals, contribution to health records, medication plans, social networks and a tie in into big data driven health-care.

1. Cause and context of the research

Patient compliance is key to therapeutic success. However, what we look at today it is not a success story whatsoever. If the patient does not understand what a physician explains, significant chances for therapeutic adherence are lost. The patient physician relationship builds the basis for compliance. However, oftentimes physicians cannot take the time to go over the medical decision making repeatedly. On the other hand, they are not available when the patient actually starts asking first or follow up questions. Often times it takes time for news to filter into a patient's system by way of coping and once that has happened no physician or healthcare professional is readily available to ask questions. The inherent information asymmetry that is significant for the common patient-physician interaction is prevalent still. In times of ubiquitous connectivity and information availability patients nowadays have the chance to go through a phase of enlightenment and reformation second unparalleled ever since the Gutenberg invention of the printing letters. However, they are mainly left to themselves on that path. The patient claims to get to the center of health-care and she does this rightfully so. Ultimately, legislators all around Europe root this idea in their recent legal changes (e.g. Patient's bill of rights in Germany). Empowerment to patients is key to getting better health-care results and thus more effectiveness for the money spent. It is the duty of the national health-care systems and the supranational organizations such as the EU for example, that deal with health-care and health-care professionals from all occupations, to support this activation.

Let's face it: HealthCare today is far from being user friendly: "From Molecule Centric to Patient centric" is more a Myth than it is Reality.

- 89% of the population aged 65 years and older is affected by at least one chronic illness.
- More than 56% of all health care expenditures are related to treatment of chronic conditions.
- 40% of the elderly people with chronic medical conditions do not take their medication on time.
- 60% of patients need a tool for assistance in taking their medication as prescribed.
- Patients who are highly satisfied with care from their relatives were able to take their medication as prescribed.

Data and Sources on file for reference

PRoF Call   iShrine – Piecing the puzzle together and solving the Compliance Conundrum

Picture 1: Patient reality is very harsh if it comes to drug compliance.

This democratization of medicine reflects the formal attitude how patients and health-care consumers go about health-care systems and health-care attitudes. We see a shift from paternalistic medicine to the consumption of health-care and the individualization, which renders physical well-being a good that needs protection long before disease strikes. Physicians see themselves become a commodity just like hairdressers every so often. Subconsciously this

poses an immense threat to narcissistic traces rooted in the long cultivated "déformacon pro-fessionelle". What used to be called prevention is now called self-care. Thus, the borders between health-care and self-care have become fluent. Patients are willing to spend actually twice as much money on self-care as they do on evidence-based health-care.

This fact pays tribute to the fact that health-care in general is quite remote from being user-friendly. "From molecule-centric to patient-centric" is more a myth than it is common reality:

We know that 40% of the elderly people with chronic medical conditions do not take their medication on time. Mostly this is because 60% of patients need a tool for assistance in taking their medication as prescribed. Nevertheless, we also know from research that patients who are highly satisfied with care from their relatives were able to take their medication as prescribed. Are the ones that do not receive satisfactory care through their relatives doomed to fall prey to their chronic condition, which renders them impossible to adhere to medication? (see picture 1).
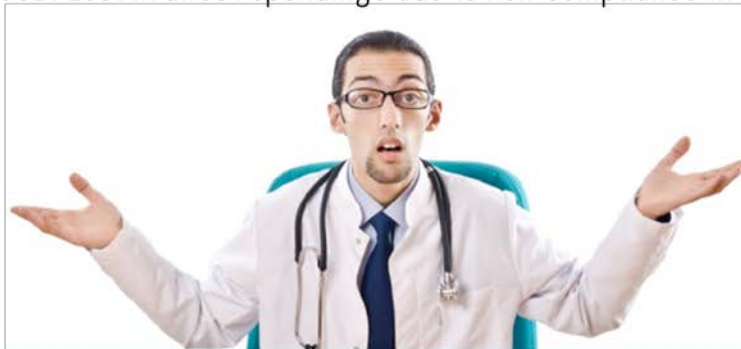

The problem with Statistical Lifes: No one watches them actually die.

100,000 Lifes: Lost per year due to wrong medication intake in the US per year.

20,000 Life Years: Lost due to non compliance to drug therapy in the US per year.

300 Billion USD: Lost in direct spendings due to non-compliance in the US per year.

Data and Sources on file for reference

PRoF Call   iShrine – Piecing the puzzle together and solving the Compliance Conundrum

Picture 2: Often times also physicians do not know how to handle the new situations – because they have never been trained or received training that did put current socio-demographic and socio-economic questions in ethics, law and economics at the center of how to actually conduct sound medical practice.

Then again, who is to blame the patient? If we look into real-world patient cases, which often times are terra incognita to decision makers and industry partners alike, we will see a very understandable dilemma:

Patient Reality Check:

87 y/o female, Alzheimer's:
31 prescriptions, 16 different medications per day.

51 y/o male, COPD:
37 prescriptions, 15 different medications per day.

85 y/o male, Autoimmune disease:
40 different medications = 56 pills per day.

Compliance isn't easy

Picture 3: Compliance is sometimes a hard thing to come by. With polypharmacy being a predominant factor, clinical studies, need real world evidences to cross the bridge from eminence based medicine to evidence based medicine and to go from waste (of time, money and lives) to effectiveness.

If we take into consideration that 89% of the population over 65 have at least one chronic disease, we have to admit that we are looking at a very prevalent issue that needs mending (picture 3).

Research shows that compliance is also always a function of care and the environment a patient lives in. Not everyone is lucky enough to be part of a household were friends or family looks after her. We must not forget the ones who dwell on their own and we have to acknowledge their rising number especially in the coming years with nurses and caregivers being on the short side of supply. This is where intelligent technology solutions for the then aged digital natives and their antecessors will need to help keep medical costs at bay [*The Need of Smart Medication Reminder for Elderly with Chronic Conditions, Fei-Hui Huang, Proceedings of the 5th international conference on Applied human Factors and Ergonomics, Poland 2014*] all over the industrial nations.

Furthermore, **patient compliance today** is rather also a structural setup problem: Often times, especially in chronic conditions that require drugs at high prices, the pharmaceutical companies whose products promise pharmacotherapeutic remedy own compliance (compare picture 4).

Compliance is a structural Challenge and it is currently owned by the Industry

C. is hardly ever addressed as an **individual panoptic and personalized patient challenge**.

Compliance to the industry is monodimensional: It is about keeping the patient on the **one drug** and making sure it is consumed properly rather than **taken in accordance with pure therapeutic reason**.

These industry sponsored **patient adherence programs** are mostly ignorant to the **patient's world of polypharmacy and multimorbidity**. It is not so much about the patient **it is about beating the competition**.

Lucentis® (DME)
1262,96 € single dose

Betaseron® (MS)
1569,65 € smallest pack

Viekirax 12,5 mg® (Hep C)
16,995 € smallest pack

This brings profit for the industry, but also poses high cost for sick funds and healthcare systems.
We address a Societal Problem **that is prevalent** from Sweden to Sicily **and from** Poland to Portugal.

Picture 4 – Patient compliance has usually been owned by one expensive drug that faces competition over price.

We may want to consider pharmaceutical battles over diseases such as:

Wet macula degeneration fought over by Novartis' Lucentis® and Bayers's Eylea® or multiple sclerosis fought over Bayer's Betaseron® and Novartis' Extavia® or the most recent one between Gilead's Havroni® and AbbVie's Viekirax® which goes over the counter at the price point of 16.995 Euros for the smallest package in Germany. Proceedings like these provide to be highly ineffective for tax funded or premium funded health-care systems. Therefore, in our opinion we need a fundamental change of view if it comes to patient compliance and adherence. Rather than a vertical silo approach such as proposed by the pharmaceutical industry, focusing on one drug at one point of time and neglecting patient reality with multimorbidity and polypharmacy, we would want to perceive patient compliance as a function of the entire horizontal value chain in patient health. For this to establish, we need physical tools at patient's arms lengths (see picture 5).
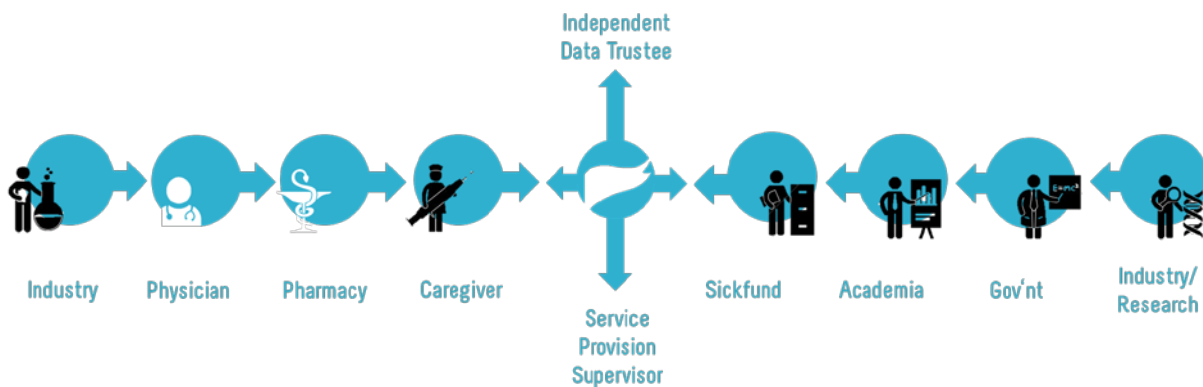
Picture 5 – *Compliance in the systemic world of health-care is a horizontal value chain with iShrine mirroring both sides of the system. Each member of the chain has a different approach on patient compliance. This calls for homogenization.*

The patient needs to get to the center and all endeavors need to gear up towards her. All of the chain members do have a different angle and a different take on compliance but their focus needs to gear more towards the patient. This will only happen if we put the patient at the center. This again only will work through patient empowerment. Ultimately, this will result in better clinical and overall real world outcomes because we will learn more about the effectiveness of individual therapies in conjunction with others (see picture 5).

We need to bridge **the mind, perception, service and data gap between players and payers** as an independent **data trustee** and a service provision supervisor. We need to boldly go into the vast realms of **Big Data in health-care**.

In order to solve the above-mentioned issues with patient compliance we have developed a prototype of a mobile drug-dispensing device that sits within iShrine and forms a natural entity.

It can be removed at an instant and will be a companion on business trips and leisure vacations. Through facial recognition, iShrine makes sure that the prescribed drugs will be dispensed to the right person at the right time of the day. iShrine also makes a follow up whether the drugs have actually been taken and automatically feeds back into the physician's database how on his side can always change the therapeutic regimen according to physical data provided by wearables and his own experience. This taps into the area of compliance measurement and generating real world evidences in order to find out about the efficacy and effectiveness of drug therapy beyond pharma initiated clinical trials.

2. Innovation results achieved

The idea and concept of iShrine as the cupboard's or cabinet's name comes from its similarity to a triptych, the mediaeval high altar with two wings on both sides and one middle part, taking credit in European history of art and architecture. Since nowadays we are spending more time in gyms etc. to live longer, rather than we do spent time in places of divine worship, I tended to call the bathroom the place of worship to the ultimate and most tangible divine entity of post-modernism: Oneself. Thus, the bathroom mirror cabinet resembles the high altar, the shrine of self-divination in health-care in a society often accused of being narcissistic about all things "i". Hence the name iShrine. It is the natural home to health and self-care from a ritual, habitual and architectural point of view.

We are using innovative technology within an infrastructure that is close to the patient's needs. People are used to bathroom mirrors and how to operate with them. The more they get literate in technology the more they will be able to use iShrine fully (see picture 6).

A novelty is the integration of an actual pill-dispensing device that comes with a whole chain of logistic for re-stocking and integrates services all around the patient's needs:

Picture 6 – iShrine is an innovative piece of technology that seamlessly integrates into the patient's world.

This is the collection of medical data through wearables and other self-care devices that patients use in their own household (see picture 7). These data go straight to an electronic patient chart where medical professionals have access to them (the permission of the client granted). They also go into a data pool once anonymized to push our knowledge on big data in healthcare beyond the known boundaries and to mirror to the patient potential risk profiles generated through computer biomarkers in conjunction with other users. This means, iShrine will be the cradle to a population based data collection service second to none.

PillBill as a mobile drug-dispensing device is integrated in a complete value chain of patient compliance. This means contemporary logistics and logistic chains will be used to stock PillBill with the medication required. One can achieve this either through care persons that visit the patient on a regular basis anyway or through mail order. This will dramatically change the business model of the local pharmacy because mail-order pharmacies will be the leading and thus changing factors.

In this, we also assume that hospitals will be very interested in the drug-dispensing device since outsourcing drug preparation will be the next big thing in hospitals to lower personal costs, reduce common costs and increase patient safety, similar to what has been done with cooking and cleaning in hospitals.

Furthermore, through the electrification of the bathroom, we provide a use to the bathroom mirror, which has been a blank space ever since. It will be a medical information dashboard, informing about vital parameters and things related to personal well-being. However, it will also be outgoing to link up with medical care and medical services (to be set up or engaged in the process). There will be connections to physicians on call who can advise with minor medical conditions or explain on the therapeutic regimen as well as answer medical questions. There will be access to nursing services and there will be opportunities for appointment making with doctors, nurses and fitness studios for example.

iShrine: The **One** Access Point for all things you.
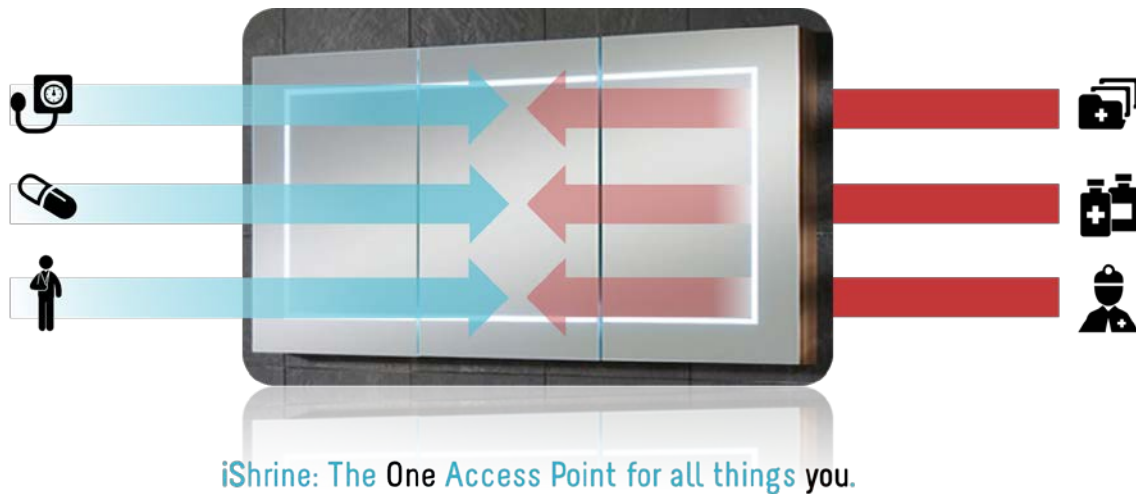
Picture 7: iShrine has different components as health-care hub that physically collects data from all kind of wearables and feeds them into the EC Database. Furthermore, pill adjustments can be made from the physician's desktop right to your station.

iShrine will be the one access point for all things you. Moreover, this entails self – care and thus provides another phase of patient empowerment or patient enlightenment. We see a huge opportunity for example for the cosmetic industry but also for OTC manufacturers to get their target audience even closer. Think of children to learn how to brush their teeth with an on-mirror computer game that turns staying healthy into a competition (paying tribute to the gamification wave). On the other hand, imagine the possibilities this interface could bring in advice services as to which eye shade to actually put on or which wardrobe matches which lip stick color. This also ties into the non-loneliness value of PRoF.

3. Link to the PRoF values

Minimal comfort: iShrine covers a topic that causes huge discomfort to patients affected. It goes beyond the common solutions like the usual pill boxes depicted in picture 8. We provide a seamless and sensitive solution to provide high tech a realm in a previously tech free zone. Patients will thus use the device without even realizing the magnitude of technology they are employing. It will render them much more mobile because their medication preparation has just been litterally outsourced.

Picture 8: How a medication reminder system needs to look like and why the pillbox is not a sustainable minimal comfort solution.

Privacy: People are able to stay at home for a longer time because the number one reason for being admitted to a nursing home is the lack of the ability to take medication on a regular basis. Even modern data safety does not provide a 100% guarantee no unauthorized personnel is seizing access to data. We will employ highest standards in data transmission to make sure no intruders will get into the system and data and data keys are hosted on different continents and server structures.

Security: iShrine provides a security network through the services that are being offered with it. If a patient does not appear to take her medication, apropriate measures will be taken folowing a previously agreed on algorithm to prevent the patient from being harmed. Further more the mirror display interface makes it possible to consult other individuals or us this interface to ask for help. Patented Xbox technology provides facial recognition. So it is made sure the right pills go to the right persons and ultrasound will do a double and a triple check before drugs are actually being dispensed to make sure these are the right drugs in the right dosage.

Anti-loneliness: iShrine comes with a visual uplink into a number of services. Even Smart TV applications can be displayed. We are looking into further services such as physician consult, nurse practitioner consult but also numerous chat fora within it. Taking credit from chat roulette, also adapted skype or other social media functions with intermediaries could be envisioned. Furthermore with PillBill being a mobile device, it is protable which will make it easier for the patient to attend social venues or keep travelling for a longer time and overall to stay in the accustomed environment rather than being moved to a nursing home.

Non stigmatising Solutions: The bathroom mirror or bathroom cupboard seamlessly integrates itself into the patient reality. Anybody with a mirror in the bathroom at an instant will be able to use the concept. No extrawork. It is unwrap, unpack, turn on and go. Furthermore

it does by no means resemble a medical device that would point to strangers or guests into a disese area or a disability. Thus the solution is completely stigma-free.

Inter-generational: iShrine provides a back end to caregivers, childeren, siblings or anyone else who is in charge with patient care. We envision a technical platform that is being used also not just for medical purposes but eg. to lead children through a gamification approach to a better dental hygiene. We could also envision school children or grand children supporting their grandparents on how to use iShrine. A goodfathership could be an option here.

Respect: iShrine supports people in their will to stay independent for as long as possible. To many patients this is the ultimate wish, not having to leave home for a nursing home. In our opinion, supporting patients to follow their will, is the biggest form of respect that can be shown.

Flexibility: iShrine is easily adeptable: It serves medical purpouses on the one hand but on the other hand it is a computer and a touch screen intereface. In the next moment it can be your window to the world or it might be a play buddy for anyone who wishes. We also envision a marketing chanel for cosmetics for example.

4. Applicable IPR rules

All of what has been described above is IP of the HealthCare Futurists Team.
The term iShrine and the technical and service infrastructure is IP of Dr. Gantner.

5. Information on the partners

Picture 9 – We have a strong and multidisciplinary team, all brought together by the spirit to help patients.

Addendum: Contact information

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We. Safe. Patients.

Power to the
Patient

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