Ross Tierney

PhD researcher

Design challenges and recommendations for the user interface of low-water toilets in urban environments

2.5 billion people lack access to adequate sanitation

(WHO 2015)

1.5 million children die every year from contaminated water

(UNICEF 2013)

The current path of sanitation

WHO Sanitation Ladder and % of world population at each level

Improved 62%
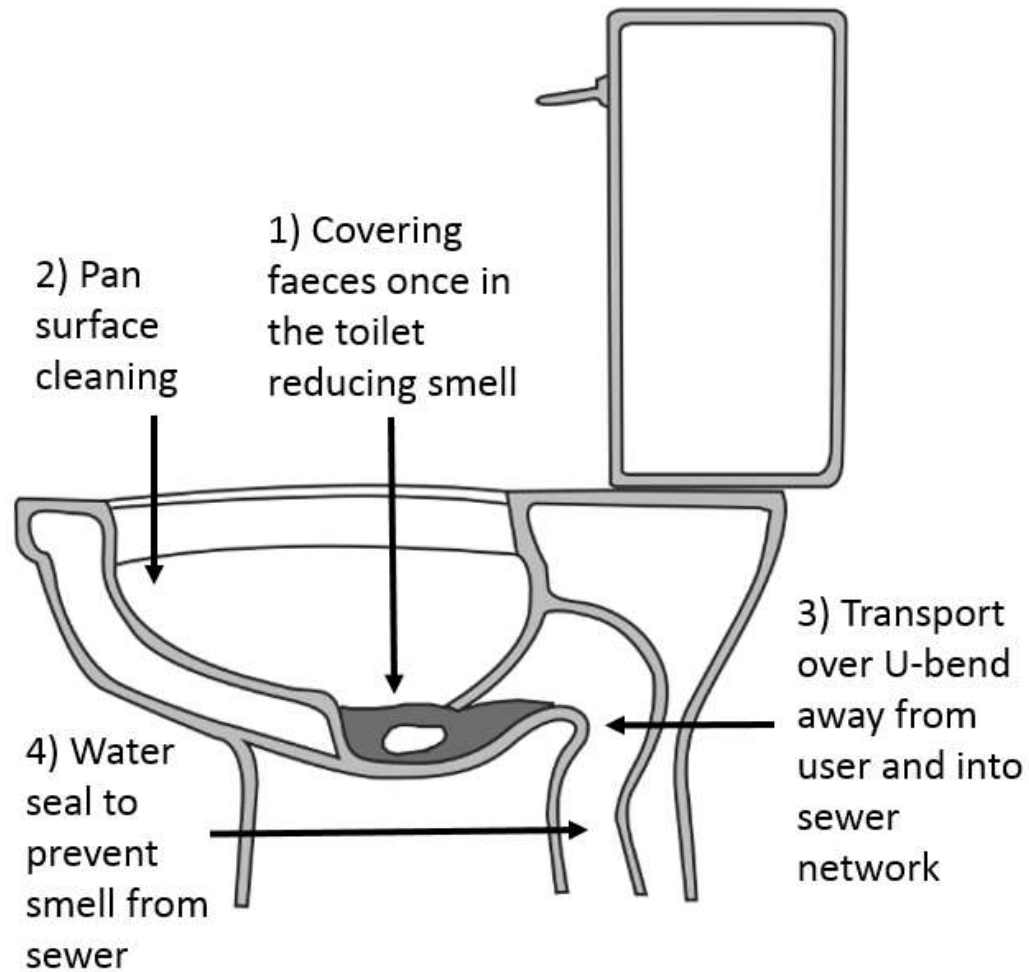
Shared 8%

Unimproved 12%

Open Defecation 18%

- 2.5 billion people will be added to the worlds urban populations by 2050, with close to 90 percent of the increase concentrated in Asia and Africa. (UN, 2014)

- By 2050, 5 billion people could be at risk of living in at least moderately stressed water conditions. (UN Water, 2016)

- Toilets use between 14% - 30% of all domestic water usage. (Willis, R. 2011)

People in the developing world lack access to sanitation, people in developed countries waste huge amounts of water on sanitation.

There isn't a single answer but there are aspects and features transferable across the whole sanitation ladder that will improve user experience and increase adoption.

The role of water

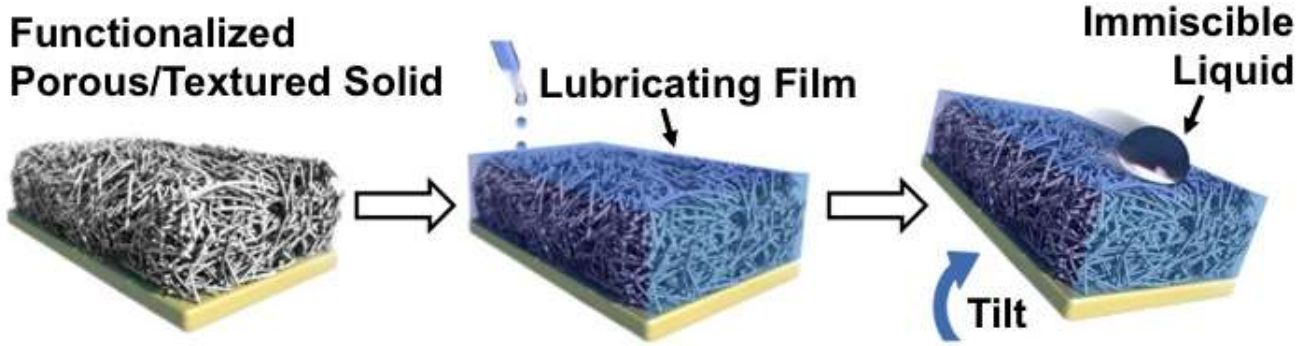**Improved**

Shared

Unimproved

Open Defecation

1) Covering faeces once in the toilet reducing smell

2) Pan surface cleaning

3) Transport over U-bend away from user and into sewer network

4) Water seal to prevent smell from sewer

- Prevent insect movement

- Reduce odour

- Block user sight of previous user's waste

Functionalized Porous/Textured Solid → Lubricating Film → Immiscible Liquid / Tilt

SLIPS demonstration with Crude Oil

Crude Oil / SLIPS / Untreated Surface → Stain-free
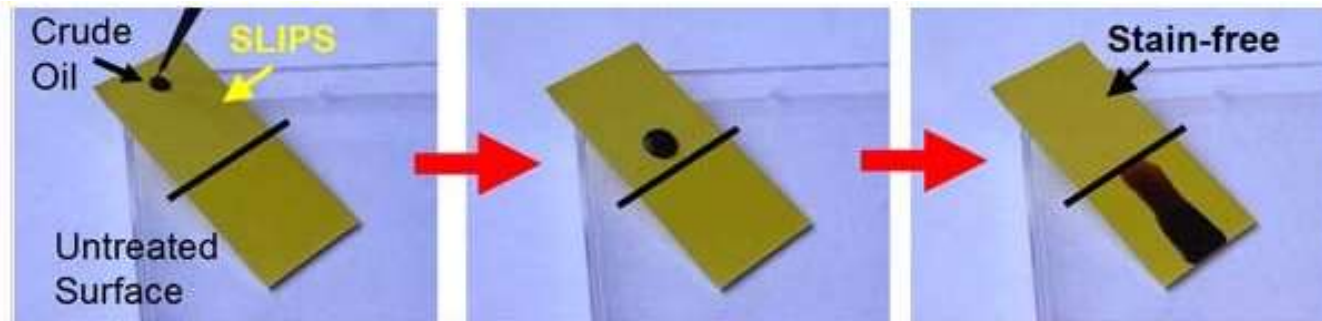
SLIPS demonstration with Crude Oil

Omniphobic surfaces have potential to reduce or perhaps even replace water in toilets and improve user experience at both ends of the sanitation ladder but are currently too early in their development.

Example of odour neutralizing technology

Bathroom wall mounted unit

In car odour neutralising

The importance of the user experience

A great deal of innovation is needed at the bottom of the economic pyramid and the market at the top has stagnated.

Primal user attitudes towards sanitation are common at both ends of the economic spectrum and can be addressed with simple transferable design improvements.

When user experience is improved the likelihood of adoption of new low-water technology will be increased.

'MOVING UP THE 'SANITATION LADDER'..!'

Existing technology to improve user experience

Improved

Shared

Unimproved

Open Defecation

- **85% reduction of water usage**
- **No change to user behaviour**

- **Prevention of insect movement**
- **Reduced odour**
- **User blocked from sight of faeces**

- **Urine diversion reduces odour of faeces.**
- **Self contained – no installation.**

References

[1] (Esrey, Andersson, Hillers, & Sawyer, 2001)

"while the average American changes his automobile every two and a half years, gets a new suit about every nine months, buys a refrigerator every ten years, and even changes his residence about every five years, he never buys a new toilet bowl. If one could design the sort of bowl that would make people want to 'trade in' their old one, this industry would benefit greatly". (Papanek & Fuller, 1982)

1 in 3 women lack access to safe toilets

A briefing from WaterAid

- 67% of the women interviewed in Lagos stated that they did not feel safe when using a shared or community toilet in a public place.[6]
- A lack of sanitation puts women at risk of shame, disease, harassment and even attack. Decent toilets would make their lives safer and healthier.

In February, a Times of India report quoted the police in the northern district of Uttar Pradesh, where the two girls were killed, as saying that 95% of rape and molestation cases took place when women and girls had left home to answer "a call of nature".

	Function
Environmental functions	7 **Integrated resource management**
	6 **Eutrophication risk reduction**
	5 **Nutrient reuse**
Health functions	4 **Pathogen reduction in treatment**
	3 **Greywater management**
	2 **Safe access and availability**
	1 **Excreta containment**