

THE POOR PRINT



A Century of Wave-Particle Duality

Andrew Boothroyd

WHAT MAKES A GOOD PHD THESIS?

One hundred years ago, Louis-Victor de Broglie completed a 70-page doctoral thesis in which he proposed that electrons, and by extension all matter, have an associated wave. Within a year or two, de Broglie's conjecture was to become one of the central ideas of quantum theory, and in 1929 the Swedish Academy of Sciences conferred on him the Nobel Prize for Physics 'for his discovery of the wave nature of electrons'.

De Broglie did not have a conventional background for a physicist. He was from an aristocratic French family, and later in life became the 7th duc de Broglie. By all accounts he was a bookish child. He immersed himself first in literary studies, and took a degree in history in 1910. He then changed direction and studied for a degree in science, which he completed in 1913.

Although remarkable, the ideas set out by de Broglie in his thesis had a solid foundation in the work of earlier greats of science. Simply put, the argument goes like this: according to Planck, light is a wave but also comes in discrete quanta of energy, and according to Einstein, particles are localised packets of energy; ergo, particles are waves.

Very soon after de Broglie's work, Schrödinger developed a quantum wave equation from which one can obtain a mathematical description of a matter wave, and around the same time

Heisenberg, Born and Jordan developed an equivalent but more general formulation of what is now known as the quantum theory.

Quantum theory is one of the most successful theories of all time. It provides a collection of mathematical recipes to calculate the observable properties and behaviour of matter very precisely. Its predictions have been tested against experiment, and in some controlled cases the agreement is better than one part in 100 million.

And yet, for the last century, scientists have been puzzling over the meaning of de Broglie's so-called wave-particle duality. The solutions of Schrödinger's quantum wave equation provide exquisite descriptions of real-world systems, but don't tell us what is behind the mathematics at a fundamental level. Is there a more satisfactory physical picture hidden behind the quantum theory, or is the mathematics of quantum theory the last word? How can Schrödinger's cat be at the same time dead and alive until we observe her, at which point the act of measurement determines her state of being? Philosophers continue to debate these and other issues.

Meanwhile, we are currently experiencing what is often termed a second quantum revolution, in which the principles of quantum theory, developed a century ago by de Broglie and others, are being applied to make quantum technologies, such as quantum secure communications, quantum computers and quantum sensors. Through these advances, quantum theory has the potential to revolutionise the way we communicate

and process information, and may lead to breakthroughs in medicine and energy production of utmost importance to humanity.

So, you want to know what makes a good PhD thesis? Ask a simple but profound question, be creative and see where it takes you.

Louis de Broglie died on March 19, 1987, at the age of 94. ■



Louis de Broglie (1892-1987)
Photograph source: Wikimedia Commons

on cooking at james st on a saturday night

EH, PL and RM

how does it taste? he asks

it tastes

like coconut milk

and thai

paste

now i must leave

in great

haste

mybedtimeis9pm



Century Puzzle

Siddiq Islam

In wishing The Poor Print a happy one-hundredth issue, I submit a puzzle of unwarranted length (sorry). The aim of the puzzle is to highlight the ambiguity of relationships and the conclusions to which we jump. As you read, check the assumptions you make along the way, remember the information you receive from each character, and appreciate the light-heartedness of the prose at the same time. I am not sure whether this is particularly clever or satisfying as far as puzzles go, but I hope that it at least has you perplexed for a short while.

YOU ARRIVE AT YOUR COUSIN RACHEL'S house a little later than expected. She has told you to come for dinner tonight, a rogue invitation considering you do not know much about this side of the family, only that they are a little unusual. Beyond the front door is an atrium with a large desk, sitting like a hotel desk, beyond which is a little moustachioed receptionist, sitting like a hotel receptionist, beyond whom is an array of room numbers, sitting on the wall like hotel room numbers.

'Hello!' pipes the man excitedly. 'You must be our cousin. It's a pleasure to meet you, and thank you for coming. I am Michael, Rachel's brother. I have been posted at the door to greet everybody. You are the last one here, and dinner is about to be served, but if you go upstairs quickly, I think Rachel would love to see you. She should be in her office in room 106.'

You thank Michael, returning his greetings and plodding up the carpeted stairs. The whole first floor is one long corridor, with each room numbered. The family must have bought an old hotel and converted it into their home. After knocking on the door numbered 106 and opening it, you see that Rachel is holding a phone up to her ear.

She whispers to you, 'Go next door to my brother's office,' before speaking again to the

voice on the end of the line. Her finger points to the room next door. She is clearly busy, so you do as she says and try room 105.

The room is empty but for the stationery scattered across the desk. 'Tinker-Taylor & Tinker-Taylor' is embossed across the top of the paper. You remember now that Rachel and her brother founded a law firm. Not the catchiest name, but good on them for running it together.

The doorknob turns and a large man staggers in. 'Sorry, who are you?' he questions, somewhat bluntly. After you explain that you are Rachel's cousin, he blurts, 'Ah, then you had better see Uncle Ben. He is down the hall.'

This man is either trying to get rid of you or lacks some social skills. Regardless, you decide it best to leave him be, and you rush out of the room and down the hallway. Unsure which room this Uncle Ben is in, you have no choice but to try each door.

In room 104, a sick girl lies in bed. She is paler than her sheets, and while you are sorry for invading her space, you can't help but feel sorry for her condition. You apologise and shut the door.

In room 103 is an elderly woman dressed in a frock. When you open the door, she whisks her head around and starts molly-coddling you. 'My grandchild! I haven't seen you since you were a tiny bean!' She suffocates you in her frilly arms. Despite her immediate familiarity, you have no idea who this woman is, and she is definitely not one of your two grandmothers.

Rushing out of there in fright, you immediately stumble into room 102, to be met by your godfather, Lord Braeburn. It is so pleasant to see a familiar face. You relate to him who you have seen so far: your cousins, the gruff man, the sick girl, and the ordeal with the elderly woman.

'Apologies for Granny Smith', he says. 'That is my sister and she has gone a bit loopy in her old age. She must have mistaken you for one of her grandchildren. That poor girl in the sickbed is my daughter, Eliza. I am worried to death about her, you know. We are not sure what has come over her but she has been rattling like a skeleton for a week now. As for Uncle Ben, he is in the room at the end of the hall with his wife Beth.'

You have finally reached the room at the end of the corridor. A middle-aged woman sits on a bed, and a dark-haired man looms over her, finger pointed. 'All because of your bloody niece!' he shouts. 'She is your niece too', states the woman, but before they can continue, they both notice you have entered the room and change face to greet you. When you tell them you are looking for an Uncle Ben, the dark-haired man says, 'Aye, that is me. How are you, lad? Are you ready for some dinner? I have cooked my home recipe of microwaveable packet rice. Let's round everyone up now, in fact. It is high time we ate. Please could you knock up the hall and let everyone know to come down to the dining room?'

Walking back up the corridor, you invite Lord Braeburn for dinner, as well as Granny Smith, trying not to get sucked into another mistaken hug. You are not sure whether the sick girl Eliza is eating, but you tell her to come anyway. Neither the tall, blunt man nor Rachel are in the office rooms, so you assume they have already gone downstairs.

In the next room, 107, a ginger man sits at his desk, with papers scattered all over. You introduce yourself and try to call him to dinner, but he insists that you sit with him for a while. 'There is something you should know about this family. It is a tragic family with a history of fighting and despairing. Your Uncle Ben and I used to run a successful ice cream company together, called Ben and Jerry's. We were going to take on the frozen-food world together, but Ben grew distant from me. He was jealous of my daughter, I am sure of it. He thought my daughter was better than his and he resented me for it. I didn't do anything that deserved him cutting me off, but he went and started his own business in microwaveable packet rice. Now I am left picking up the pieces trying to come up with other convenient foods that can compete with his. What do you think about microwave-

able packet pizza? Packet bolognese? It's just not the same ...'

You leave Uncle Jerry to lament alone and move on to room 108. It is a playroom where several young girls lie playing with toys strewn across the floor, and watching over them is the large, blunt man from the office. He looks as though a kind of idle sadness has washed over him as he watches the children. 'My biggest regret in life', he tells you, 'is not having children. Look, everyone else has them, and they bring their parents so much joy. Come on, kids, it's time to eat!'

In room 109 are a fair girl and boy, unpacking their bags. They look upset, but you don't know who they are, and frankly you are quite unbothered at this point to find out. You notify them to come to the dining room and swiftly leave.

In the hallway, you bump into Michael again. He asks you how you are doing, and you tell him you are starting to get confused working out who is related to whom, so he helps you out. 'Lord Braeburn has only two children, as does Granny Smith. There in that room was Artemis with her brother Apollo. They have just moved in to look after their mother since they are both doctors. She is the niece that Uncle Ben doesn't like, and speaking of nieces, I have just worked something out ... everyone has a niece here except you! Now please could you help me set the table? I'm not a lawyer or a doctor; I am just a waiter with no help!' ■

Thank you to all Orielenses, past and present, who have read or contributed to this humble newspaper since Michaelmas 2015! One hundred issues stands as a testament to the creativity and enthusiasm of college members, and we're eternally grateful for your support.

The Poor Print needs fresh blood to take it through the next hundred issues and beyond. If you'd like to join the team and make a mark on college life, get in touch with us at thepoorprint@oriel.ox.ac.uk - no prior journalistic/publishing experience necessary.





爷爷 (2021)
by David Akanji

Editor's note: A colour version of this painting is available on our website.

A Word from the Editors

Siddiq Islam

Now that one hundred *POOR PRINTS* have come and gone, what better a time for us editors to reflect on our time with this wonderful student publication. *The Poor Print* for me represents not only a physical newspaper, but the courage and talent with which Oriel students share their writing and art with others. I feel as though I have benefited from the constant stimulus that *The Poor Print's* fortnightly themes give – it has encouraged me to keep writing and keep sharing, and I am eternally grateful for that – but more than this, I have enjoyed seeing my fellow collegemates produce such a wide variety of content every issue.

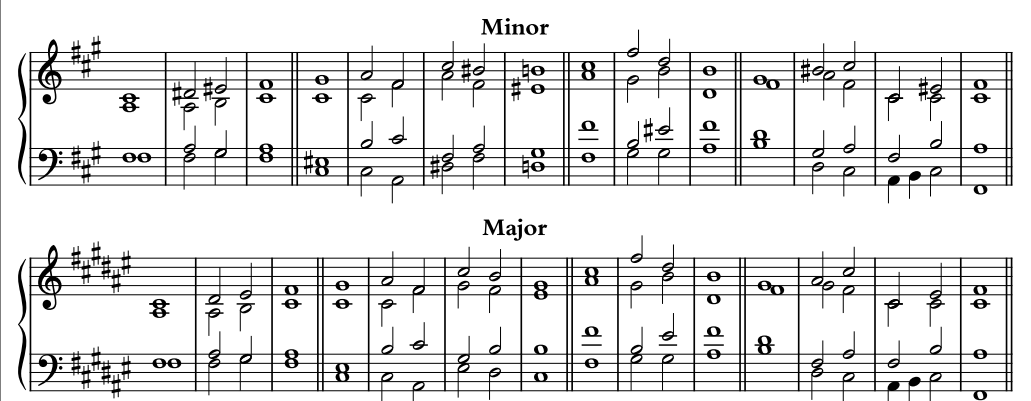
Perhaps surprisingly, I am not old enough to have witnessed all one hundred *Poor Prints* personally (although I have at this point read every single 'Dear Beary' entry to date). I have, though, been here for the past forty-four issues (four years of *Poor Printing!*) I am always blown away by the range of submissions that *The Poor*

Print attracts. We have seen Australian cryptic crosswords; tuck-shop poetry diss battles; a whole series of Horrid Henry-themed poems and drawings; musical compositions, song playlists, and SoundCloud song demos; and not to mention the incredible drawings and paintings of late.

Now in my fourth year as an editor of *The Poor Print*, I can safely say that the publication has never overflowed with submissions. Oftentimes, we editors scramble to fill the spaces at odd hours (as my botched prose puzzle this week might attest). Nonetheless, it always manages to stay in print, and I am astonished that the students of Oriel never stop giving. Thank you to all those who have contributed to *The Poor Print*, and I wholeheartedly encourage you to continue. This paper is not made of paper but of the thoughts and dreams of Oriel students, and I hope that *The Poor Print* will go on to produce hundreds and hundreds more ... ■

Cantus Psalmorum

Jerric Chong



AULT: Reflecting on the Future of Architecture

David Akanji

Welcome to AULT, the arts and culture column of The Poor Print, written by David Akanji (me). AULT exists to refocus our minds, re-engaging ourselves with art and cultural understandings. I'll be focusing on current opinions/events/issues in the art world, but more importantly how we as students, citizens, and humans fit into it. If there are any topics or events you want covered, reach out to me at david.akanji@oriel.ox.ac.uk

Reflecting on the future of architecture: Notes on Lesley Lokko's RIBA Gold Medal, the spectrum of practice, and the Biennale

RECENTLY I'VE BEEN THINKING A LOT ABOUT diversity in architecture following Lesley Lokko's RIBA gold medal win. My sister is a final year BA Architecture student, and first and foremost as a black woman. This raises an important question: is there a strong space for professionals of colour? Lesley talks about the intersectionality of many of the issues architecture might be facing in the contemporary setting. In listening to her interview with *Architectural Record* editor-in-chief Cathleen McGuigan, Lesley discusses what it means to understand diversity and sustainable practice. Lesley makes the argument that a lot of decentralisation is needed in order to decolonise the practice of architecture.

The British Pavilion at the Biennale this year to me was a vision, a prophecy into what the spectrum of architectural practice is beginning to look like – it is not only space in plan and section. It is chair, object, artefact – it is Mac Collins's sculpture; it is Joseph Zeal's ceramic clay creations. Yet it is also wonderful architectural models by Adjaye Associates and the sounds of architect Yussef Agbo-Ola.

But what does this mean? From my own understanding, I'm not entirely sure that I know what the practice of architecture means – but I sense that Lesley was referring to how architects design, the sentiment, the knowledge that inspires and the attention to the people and cultures for which the architect designs. RIBA describes the practice of architecture as being a vocation of service:

'We serve our members and society in order to deliver better buildings and places, stronger communities and a sustainable environment.'

I very much agree with this, and would say that this is how I see and understand what it means to practise architecture. Interestingly an article in *Law Insider* describes the practice of architecture as the 'totality of acts, performances of services and provision of advice by an architect in relation to design or construction.' Here the practice of architecture is understood to be the 'performance' of service and in a more corporate understanding, an exchange of goods.

This is not a bad thing. No one ever wants to acknowledge that architecture is a business and people need to make money. Why would they? It's crude. You spend three years imagining and projecting a better future, diverse spaces and practical, soul-filling design that's good for you and good for me. But the reality is, you'll pay a mortgage. Then you'll buy a car. Then you'll pay for some school uniform (maybe). But for whatever reason the love of humanness stops with the architect themselves. Endless critique and a general fear of talking about money means that we haven't been able to face some of these problems head-on because we're all busy trying to be the revolutionary that doesn't talk about money, or taxes, or mortgages.

This isn't to say that there aren't any issues. Lesley Lokko's specific reference to decolonisation discusses the legacy of slavery in an epistemological way. She describes how the black body being the first unit of energy has impacted the relationship building has with people. In a similar essence, we see the exploitation of many architects at all levels within the industry in the form of unpaid overtime, unrealistic or unhealthy expectations relation to when one should be working and the general underpayment of staff. ■



Runout by Mac Collins
at La Biennale di Venezia 2023

Photograph credit: Oliver Wainwright



ORIEL TALKS

Date: **4 March** (Monday, 8th week)
Time: **6pm–7pm**

Venue: **Harris Lecture Theatre**

Showcasing the varied research interests of Oriel MCR members, this term's speakers are:

Anca Marin

'Truth and Ethics in Journalism: Walter Duranty and the Cover-Up of Holodomor'

Pranav Kishore Saxena

'"White Man's Burden"?'
or the Myth of the White Saviour'

THE POOR PRINT TEAM

Executive Editors

Siddiq Islam
Jerric Chong
Ayomikun Bolaji

Associate Editors

David Akanji
Sam Hardaker
Claudia Hutuleac
Carolina Cortés Vilaplana
Yu Yan

thepoorprint@oriel.ox.ac.uk

