К.В. Вороніна

# ОСНОВИ ПЕРЕКЛАДАЦЬКОГО АНОТУВАННЯ ТА РЕФЕРУВАННЯ

# ТЕКСТІВ РІЗНИХ ТИПІВ І ЖАНРІВ

**Навчальний посібник**

Харків – 2013

**Рецензенти**: кандидат філологічних наук, професор, завідувач кафедри германської та романської філології Харківського гуманітарного університету «Народна українська академія» **Т.М. Тимошенкова**;
кандидат філологічних наук, доцент, доцент кафедри теорії та практики перекладу англійської мови Харківського національного університету імені В.Н. Каразіна **І.М. Каминін**.

*Затверджено до друку рішенням Вченої ради*
*Харківського національного університету імені В.Н. Каразіна*
*(протокол № 11 від 25 листопада 2013 р.)*

Посібник пропонує теоретичні засади та практичні рекомендації з анотування та реферування й виконання анотаційного та реферативного перекладу текстів різних типів і жанрів, що є необхідною складовою формування професійної компетенції майбутніх перекладачів-референтів.
Навчальний посібник призначено для студентів 4 курсу освітньо-кваліфікаційного рівня «бакалавр» денної форми навчання факультету іноземних мов.

**ВСТУП**

Спецкурс «Основи анотування та реферування текстів різних типів та жанрів» належить до циклу дисциплін професійної та практичної підготовки, передбачених програмою підготовки спеціалістів за фахом «Переклад».

Метою спецкурсу є створення теоретичної бази, необхідної для подальшого удосконалення професійної компетенції майбутніх перекладачів-референтів, здатних працювати у науково-технічній та інформаційних галузях, а також формування необхідних вмінь та навичок анотування й реферування текстів різних типів та жанрів із використанням різних методів інформаційного згортання. Навички смислової компресії тексту перебувають в основі здійснення анотаційного та реферативного перекладів – необхідної складової професійної компетенції майбутнього перекладача.

Навчальний посібник «Основи перекладацького анотування та реферування текстів різних типів і жанрів» передбачає викладення загальних теоретичних засад анотування та реферування, ознайомлення з особливостями анотування та реферування текстів різних типів і жанрів, з різними методами укладання анотацій та рефератів залежно від їх функціонального призначення. Посібник містить практичні поради до складання анотацій та рефератів, а також виконання анотаційного та реферативного перекладів, відповідні вправи, метою яких є удосконалення навичок інформаційної компресії. Наведені науково-технічні, науково-популярні тексти та тексти інформаційних повідомлень для укладання анотацій та рефератів і здійснення анотаційного та реферативного перекладів з англійської мови українською.

Перша частина посібника ґрунтується на огляді сучасного стану реферативної справи, що викладена у відповідній літературі з основ анотування та реферування. Методика укладання анотацій та рефератів спирається на матеріали навчального посібника Є.С. Смирнової, Г.А. Чередниченко «Англійська мова» (Київ, 2011), а також на розробки фахівців у галузі реферування (В.М. Варенко, Г.Ю. Гребінник, М.Б. Сорока).

## ЧАСТИНА I
## ТЕОРЕТИЧНІ ЗАСАДИ АНОТУВАННЯ ТА РЕФЕРУВАННЯ

Анотування та реферування належать до аналітико-синтетичних процесів, сутність яких полягає в інформаційній компресії певного документу, що дозволяє отримувати вторинну інформацію у вигляді відповідно анотації та реферату.

Анотація та реферат як результати аналітико-синтетичної обробки первинних документів широко розповсюджені в бібліографічній, видавничій, інформаційно-аналітичній та науково-інформаційній діяльностях. У кожній зі сфер діяльності поняття «анотація» та «реферат» мають дещо відмінні трактування, існують також характерні особливості укладання анотацій та рефератів залежно від їх мети, цільового призначення, типу та жанру документа, що підлягає анотуванню та/або реферуванню. Незважаючи на наведені розбіжності, вважають за доречне вивчати теоретичні та методологічні засади анотування та реферування з позицій загальної теорії бібліографії, яка поєднує всі аналітико-синтетичні процеси вироблення бібліографічної інформації.

### 1. Анотація та реферат як основні поняття загальної теорії бібліографії

#### 1.1. Поняття «первинних» та «вторинних» документів
Сучасний рівень інформатизації суспільства висуває високі вимоги до рівня інформаційної компетентності спеціалістів усіх галузей; спеціаліст сьогодні має опрацьовувати великі обсяги професійної інформації, включаючи іншомовну. Одне з базових умінь, що покладено в основу будь-якої професійної діяльності, – це вміння працювати зі спеціальною літературою, а саме робити інформаційну обробку текстів.

Метою інформаційної обробки є добування корисної інформації з даної проблематики, передача змісту в більш-менш розгорнутій формі залежно від практичної цінності та потреб її подальшого використання.

Важливішим джерелом наукової та технічної інформації й засобом її передачі у просторі та часі слугує науковий документ. Усі письмові матеріали, що задіяні в існуючому потоці наукової та технічної інформації, поділяють на **первинні** та **вторинні**. Поняття *первинних* та *вторинних* текстів запозичені до прикладної лінгвістики тексту з інформатики (теорії науково-технічної інформації), де ознака первинності/вторинності слугує підґрунтям класифікації інформаційних документів.

**Первинні** матеріали/документи є джерелом вихідної інформації; це документи, які відображають результати пізнання реального світу та духовної діяльності людей у вигляді опису фактів, відносин між ними, виявлених закономірностей тощо. До первинних матеріалів зараховують: монографії, збірки, матеріали наукових конгресів, конференцій, симпозіумів, підручники, посібники, брошури, журнали, статті, газети, спеціальні публікації

(інструкції й методичні посібники, галузеві довідники, наукова та технічна документація) та інші видання.

***Вторинний матеріал/документ*** – документ/текст, отриманий в результаті аналітико-синтетичної обробки одного або декількох первинних документів/матеріалів із метою їх подальшого використання. Вторинний документ містить не тільки інформацію першоджерела, яку представлено в згорнутому, скороченому та узагальненому вигляді, але й відомості про первинний документ, його форму (тип, вид, рік та місце видання тощо). Прикладами вторинних документів є реферативні, бібліографічні, інформаційні посібники, каталоги, списки, огляди, бази даних і т. і. До вторинних належать такі види текстів, як пошукова анотація, бібліографічний опис, анотація, реферат, конспект, переклад, рецензія, синопсис.

### 1.2. Поняття аналітико-синтетичної обробки документів: бібліографічний опис, анотація, реферат

Обробка документа – один із найстаріших видів діяльності. Як тільки кількість документів досягла надзвичайно великої кількості, коли неможливо було ними керувати, виникла потреба їхнього представлення в стислій формі. Обробка документа – це сукупність взаємопов'язаних, взаємозалежних процесів формування елементів бібліографічного запису за допомогою *аналізу* та *синтезу*.

*Аналіз* та *синтез* (грец. *analysis* – розкладання та *synthesis* – поєднання) – у найзагальнішому значенні – процеси мисленнєвого та фактичного розкладання цілого на складові частини та об'єднування цілого з частин.

Аналітико-синтетична обробка документів полягає в представленні кожного конкретного документа або їх певної сукупності в такому вигляді, що максимально відповідає тому чи іншому завданню науково-інформаційної діяльності. Потреба в здійсненні аналізу та синтезу наукової інформації спеціальними службами виникла в результаті прискореного розвитку науки та техніки, а саме:

- кількість наукових документів, які з'являються в будь-якій галузі, стає надто великою; науковці не мають достатньо часу навіть для швидкого перегляду всіх нових видань, що відповідають їх інтересам;
- виникла гостра потреба не тільки у відомостях про наукову інформацію, але й у самій науковій інформації, тобто в конкретних фактичних даних або в так званій фактографічній інформації. Така інформація має бути попередньо опрацьована з урахуванням її призначення та використання;
- наукова-інформація однієї тематики може бути розсіяною по різноманітних документах, надрукованих у різний час, різними мовами та в різноманітній формі. Отже, виникає потреба не тільки в її збиранні та систематизації, але й у її критичній оцінці та узагальненні.

До основних видів аналітико-синтетичної обробки документів належать:
- бібліографічний опис;
- класифікація (індексування) документів;
- анотування;
- реферування;
- переклад з однієї мови іншою;
- укладання оглядів.

Кожному виду вказаної обробки притаманне певне співвідношення аналізу та синтезу. Так, наприклад, під час підготовки оглядів синтетична робота сягає свого максимуму, в той час як переклад наукової літератури взагалі її не потребує. У процесі створення вторинного документа відбувається *згортання* інформації, що полягає в зменшенні її фізичного обсягу, зміні знакової форми (під час індексування), оцінці наукової та практичної цінності документа тощо.

Наведені вище види аналітико-синтетичної обробки документів удосконалювалися протягом сторіч у зв'язку з розвитком видавничої та бібліотекарської справи, бібліографії, прикладної лінгвістики та організації наукової праці. Однак лише з виникненням інформатики вдалося виявити їх внутрішній взаємозв'язок, належність до одного типу операцій, а також поставити питання про їх механізацію та автоматизацію.

Під час аналізу документу виявляють його основні бібліографічні відомості: описові, індексаційні, анотаційні, реферативні та інші. Вони синтезуються в бібліографічному описі, заголовку, термінах індексування, анотації, рефераті, а всі разом – у бібліографічному записі.

***Бібліографічний запис*** – елемент бібліографічної інформації, який фіксує в документальній формі відомості про документ, що дозволяють його ідентифікувати, розкрити його складові частини та зміст із метою бібліографічного пошуку.

До складу бібліографічного запису належать:
- бібліографічний опис;
- заголовок бібліографічного запису;
- терміни індексування (класифікаційні індекси та предметні рубрики);
- анотація (або реферат);
- дата завершення обробки документа;
- відомості службового характеру.

Обов'язковим елементом бібліографічного запису є бібліографічний опис, щодо решти компонентів, то вони можуть змінюватися залежно від мети та завдань.

***Бібліографічний опис*** – частина бібліографічного запису, що становить сукупність бібліографічних відомостей про документ, які, наведені за певними правилами, дозволяють його ідентифікувати та надати йому загальну характеристику.

Бібліографічний опис (мовою оригіналу публікації) повинен містити наступні елементи:
- прізвище та ініціали автора (авторів);

- заголовок;
- підзаголовні відомості;
- вихідні відомості;
- кількісна характеристика;
- надзаголовні дані;
- примітки.

*Анотація* як частина бібліографічного запису – стисла характеристика первинного документа з точки зору його призначення, змісту, виду, структури, форми та інших особливостей. Під час анотування головним об'єктом аналізу є текст документу. Такий аналіз може переслідувати дві різні мети:
- виявити провідну тему або предмет, що досліджує автор першоджерела, а також основні ідеї та факти, пов'язані з цією темою або предметом;
- визначити, наскільки даний документ відповідає науковим або практичним інтересам певної групи вчених або дослідників.

Крім бібліографічного запису, анотації можна знайти на зворотній сторінці титульного аркуша періодичного друкованого видання. Вони вкладаються до художніх творів або науково-популярної літератури, містять короткі відомості про твір, стислий виклад змісту книги.

*Реферат* – стислий точний виклад змісту документу, який поєднує основні фактичні відомості та висновки без додаткової інтерпретації або критичних зауважень автора реферату. Реферат слугує для орієнтування в інформаційному просторі. Наявність у бібліографічному записі реферату свідчить про те, що первинний документ, який відображено в ньому, заслуговує на увагу з боку вчених відповідних галузей наукової та прикладної діяльності.

## 2. Сутність анотування та реферування

Сутність анотування та реферування полягає в максимальному скороченні обсягу джерела інформації із суттєвим збереженням його основного змісту. Принциповою основою для такої компресії інформації є надмірність мови, відсутність однозначної відповідності між змістом думки та формою мовленнєвого твору, який цю думку висловлює.

Процес анотування можна трактувати як 1) різновид інформаційного згортання; 2) процес аналітико-синтетичної переробки інформації, результатом якого є анотація. Відповідно, анотування можна схарактеризувати як інформаційний процес складання коротких відомостей про першоджерело, перше з ним знайомство, яке дозволяє зробити висновок про доцільність його подальшого детальнішого вивчення.

Реферуванням називають 1) процес інформаційної діяльності; 2) логічний метод переробки документальної інформації. Реферування — найтиповіший процес інформаційного аналізу, пов'язаний з вивченням і обробкою документів з метою вилучення із них найсуттєвіших відомостей та (або) їх узагальнення. Реферування – це інтелектуальний творчий процес, який поєднує осмислення, аналітико-синтетичну обробку інформації та створення нового документа – реферату.

Реферування також відбувається в навчальних цілях. Реферативну діяльність, що здійснюється в процесі навчання іноземним мовам, характеризують як рецептивно-репродуктивну мовленнєву діяльність, яка має високий навчальний потенціал [4]. На першому етапі сприйняття іншомовного тексту мовленнєві дії студентів спрямовані на його декодування, на другому – на смислову переробку інформації. Отже, окрім активізації навичок різноманітних видів читання (наприклад, реферативного, оглядового, конспективного тощо), смислова компресія тексту призводить до мотивованого засвоєння іншомовного матеріалу та сприяє формуванню необхідних мовленнєвих навичок та умінь [6].

Здійснюючи компресію першоджерел, анотація та реферат роблять це принципово різними способами. Для кожного з цих видів характерний певний ступінь згортання інформації на основі її попереднього аналізу, що докладніше викладено в наступних розділах.

## 2.1. Анотація

### 2.1.1. Поняття анотації

Поняття **«анотація»** трактується з посиланням на латинське *annotatio – зауваження, примітка*. Зазвичай тлумачать це поняття таким чином: 1) коротка, стисла характеристика змісту та перелік основних питанькниги, статті, рукопису тощо, 2) гранично стисла характеристика матеріалу, що має чисто інформаційне (або довідково-бібліографічне) призначення, 3) стислий виклад джерела з розкриттям його основного змісту з усіх порушених питань, супроводжуване оцінкою й висновками референта, 4) украй стислий з усіх можливих викладів головного змісту першоджерела, що укладене в результаті компресії тексту оригіналу, та який у декількох рядках надає уявлення про його тематику [1, 2, 5].

Анотація – один із важливих засобів наукової комунікації, що часто використовується в інформаційно-пошуковій системі. Вона сприяє орієнтації користувачів інформації в документальних потоках, у системі документальних комунікацій у цілому, допомагає відібрати потрібну літературу, націлити читача на особливості змісту й форми документа.

Мета анотації – інформувати читачів стосовно основного предметно-тематичного змісту документа, аспектів розгляду теми, матеріалу, на базі якого проведено дослідження, його географічних аспектів та хронологічних рамок.

Анотація поєднує характеристику основної теми, проблеми об'єкта, цілі роботи та її результати. У ній наводять також, що нового містить в собі даний документ порівняно з іншими, спільними за тематикою та цільовому призначенню документами. Сутність та призначення анотації полягає в тому, що вона дає стислу характеристику самого джерела інформації й висвітлює питання, які розглядаються у первинному документі.

На відміну від реферату, який дає можливість читачеві познайомитися з суттю змісту першоджерела, анотація не розкриває зміст документа, в ній не

наводяться конкретні дані, характеристики, методики тощо, вона дає лише найзагальніше уявлення про зміст першоджерела.

### 2.1.2. Класифікація анотацій

Анотації класифікують залежно від:
- видів анотованої літератури (художня чи наукова література, публікації документів тощо);
- цілей та функцій анотацій (видавнича, для масових бібліотек тощо);
- інформативності та глибини розкриття змісту документа.

На основі **функціонального** підходу до класифікації анотацій розрізняють *довідкові* та *рекомендаційні* анотації.

*Довідкові* анотації, які також називають *описовим*, або *інформаційними*, характеризують тематику документа, повідомляють розширені відомості про автора, а також форму, зміст, жанр, призначення й інші особливості документа, але не надають його критичної оцінки.

*Рекомендаційні* анотації характеризують документ з огляду на його цільове та читацьке призначення; вони вказують на призначення документа для певної категорії споживачів з урахуванням їх рівня підготовки, віку та інших особливостей. Покликані зацікавити та привернути увагу читачів, рекомендаційні анотації можуть містити методичні та педагогічні рекомендації та поради.

**За повнотою охоплення змісту** документа, що анотується, та **читацьким призначенням** анотації діляться на *загальні* та *спеціалізовані*.

*Загальні* анотації характеризують документ у цілому та розраховані на широке коло користувачів.

*Спеціалізовані* характеризують документ лише в певних аспектах та розраховані на вузьке коло спеціалістів. Різновидом спеціалізованої анотації є аналітична анотація, яка дає коротку характеристику тільки тих розділів, параграфів та сторінок документу, які присвячені певній тематиці. Спеціалізовані анотації найчастіше мають довідковий характер.

За критерієм **глибини згортання інформації** виділяють *розширені* та *реферативні* анотації.

*Розширені* анотації, крім характеристики первинного документа, можуть містити додаткову інформацію: відомості щодо історії його написання, поширеності серед читачів, видань іншими мовами тощо.

*Реферативні* анотації містять основні положення й висновки першоджерела; це синтез індикативних та інформативних методів згортання інформації, інколи цей вид анотацій називають індикативним рефератом.

Залежно від **кількості опрацьованих джерел** анотації бувають *монографічні* та *зведені*.

*Монографічні* передають зміст одного першоджерела, *зведені (оглядові)* – декількох вихідних документів, що тематично пов'язані між собою.

Залежно від того, ким укладено анотацію, розрізнюють **авторські** (укладені автором першоджерела) та **неавторські** (іншою особою).

У практиці анотування мають місце різні типи анотацій, у яких поєднуються функціональні ознаки та засоби характеристики документа. Завдяки чому і довідкова, і рекомендаційна анотації бувають до того ж загальними, спеціалізованими або зведеними.

Референти-перекладачі науково-технічної літератури переважно складають довідкові (описові) анотації до матеріалів науково-технічного та техніко-економічного характеру.

### 2.1.3. Функції анотацій

Анотація – багатофункціональний вторинний документ. До провідних функцій анотацій зараховують пошукову, індикативну, оцінну.

Реалізація *пошукової* функції пов'язана з установленням місцезнаходження першоджерела на основі документографічних ознак: вид документа, автор, заголовок, вихідні дані тощо.

*Індикативна* функція реалізується шляхом доведення до споживачів відомостей про існування та зміст документів, релевантних до їх інформаційних потреб. Індикативність передбачає здатність споживача прийняти рішення щодо доцільності звертатися до первинного документа на основі його анотації.

*Оцінна* функція передбачає рекомендацію даного першоджерела тому чи іншому споживачеві. Рекомендація може ґрунтуватися як на характеристиках документа, так і на типологічних характеристиках читачів.

### 2.1.4. Структура анотацій

Як правило, анотація складається з трьох частин:
1. вступна частина – бібліографічний опис, який поєднує назву першоджерела, прізвище та ім'я автора мовою оригіналу, назву видання (журналу або книги), видавництво, рік, місяць, номер видання, сторінки, мову публікації;
2. основна частина – описова – містить перелік основних проблем і положень оригіналу та дуже стислу характеристику матеріалу публікації;
3. заключна частина – завершальна – розкриває стислу характеристику призначення першоджерела, посилання на бібліографію та кількість рисунків тощо.

### *2.1.5. Загальні вимоги до написання анотацій*

1. Урахування призначення анотації. Від цього залежить повнота охоплення та зміст заключної частини.
2. Обсяг анотації. Обсяг залежить від значимості анотованого матеріалу, його особливостей та призначення; коливається від 500–2000 друкованих знаків.
3. Дотримання логічності структури, яка може відрізнятися від порядку викладання в оригіналі.
4. Дотримання мовних особливостей анотації, що поєднує наступне:
- виклад основних положень оригіналу ясно та стисло;
- уникнення повторів;
- виконання правил єдності термінів та скорочень;
- використання загальносприйнятих скорочень;
- уникання використання прикметників, прислівників, вставних слів, які не впливають на зміст;
- вживання деяких узагальнюючих слів та словосполучень, які демонструють логічні зв'язки між окремими частинами висловлень.

### *2.2. Реферат*

### *2.2.1. Поняття реферату*

З приводу етимології терміну «реферат» існує досить поширене припущення, що він походить від латинського *reffere* – «повідомляти», «сповіщати». Згідно з іншою точкою зору, слово «реферат» отримало поширення в англомовній літературі в епоху середньовіччя від *abstractus* у значенні *drawn away* – «виключений, вилучений».

У сучасній літературі з теорії та практики анотування та реферування існує велика кількість дефініцій поняття «реферат», що обумовлено комплексним характером завдань, поставлених під час дослідження даного виду інформаційних документів. Наведімо деякі з поширених визначень. Так, під «рефератом» розуміють: 1) модель оригіналу, що пропорційно відображає його складові частини, 2) інтегральну модель первинного документа, в якій інформацію подано в узагальненому вигляді, 3) текст, побудований на основі смислової компресії першоджерела з метою передачі його головного змісту, 4) текст, що точно, але стисло подає зміст будь-якого документа без додаткової інтерпретації або критичних зауважень і без посилання на автора цього тексту [1, 2, 5].

Реферат не тільки перераховує всі основні питання першоджерела, але й повідомляє суттєвий зміст кожного з них. **Реферат** – стисле точне викладення змісту документа, що включає основні фактичні відомості й висновки, без додаткової інтерпретації або критичних зауважень автора реферату. Реферат може вповні відобразити всі елементи структури першоджерела, його методичні та концептуальні особливості, статистичні та довідкові відомості. За

11

необхідності навіть може замінити першоджерело, до якого за певних причин немає доступу.

### 2.2.2. Класифікація рефератів

Класифікація рефератів здійснюється за такими ознаками:

**За належністю до певної галузі знань** – реферати з суспільних, гуманітарних, природничих, технічних точних та інших галузей науки.

**За типами організації ключового матеріалу**:
- *інформативний реферат (реферат-конспект)* – покликаний дати більш повне уявлення про зміст оригіналу. Містить в узагальненому вигляді всі основні положення оригіналу, відомості про методику дослідження та сферу застосування, передає важливі фактичні та теоретичні відомості. Інформативність реферату досягається внаслідок скороченого викладення змісту першоджерела. У такому рефераті має бути вказано предмет дослідження та мету роботи, вміщено дані про метод і умови дослідження, висвітлено результати та пропозиції автора щодо їх застосування, наведено основні характеристики нових технологічних процесів, технічних виробів, нову інформацію про відомі явища, предмети та ін. Послідовність викладу матеріалу виступає як головна вимога, що висувається до такого реферату [5];
- *індикативний реферат (реферат-резюме)* – укладається на основі аспектів змісту первинних документів; містить не всі положення оригіналу, а лише ті, що тісно пов'язані з темою документа, який реферується. В такому рефераті наводиться лише коротке резюме; за характером викладу він наближається до анотації. Як правило, цільове призначення реферату-резюме – привернути увагу до наукового документа; він не замінює першоджерело, а лише надає можливість прийняти рішення про необхідність звертання до нього. Вирішальним є не послідовність викладення матеріалу (як це передбачено в інформативному рефераті), а логіка бібліографічного задуму. Вона полягає у виділенні найголовнішого та найактуальнішого в документі. У такому рефераті немає детальної фактографічної інформації, практичних і теоретичних результатів, висновків [5];
- *змішаний реферат* містить елементи індикативного та інформативного реферату. Такі реферати готуються на найбільш складні, об'ємні роботи, які містять велику кількість інформації за різноманітними аспектами.

**За кількістю джерел реферування** реферати можуть поділятися на:
- *монографічні* – реферати, які складені на одне джерело;
- *оглядові (зведені, групові)* – реферати, коли до роботи залучається кілька або ціла низка тематично споріднених реферованих праць;
- *аналітичні (реферати-фрагменти)* – реферати, які складаються на окрему частину первинного документа, його розділ, підрозділ, параграф.

**За читацьким призначенням:**
- *загальні* – які викладають зміст документа в цілому та розраховані на широке коло читачів;
- *спеціалізовані* – де виклад змісту орієнтований на спеціалістів у певній області знань.

**За укладачем:**
- *авторські (автореферати)* – написані самим автором дисертації, монографії тощо;
- *неавторські* – складені працівниками реферативної чи інформаційно-бібліографічної служби.

**За способом реферативного синтезу:**
- *реферат-екстракт* – реферат, який являє собою сукупність фрагментів вихідного тексту. Задля укладання цього реферату використовується такий спосіб викладу інформації, як цитування, тобто дослівне відтворення інформативних фрагментів первинного документа. Реферат-екстракт укладається за використання так званих формалізованих підходів до реферування;
- *«перефразований реферат»* – реферат, який отримано на основі перифразу вихідного тексту. Перефразування передбачає пропуск значної частини відомостей із первинного документу та перебудову його смислової та синтаксичної структури, яка досягається за рахунок операцій заміщення, суміщення та узагальнення. Перефразування є найбільш поширеним способом викладу інформації;
- *реферат-інтерпретація* – реферат, який отримано на основі інтерпретації вихідного тексту. Інтерпретація – найскладніший спосіб реферативного викладу, оскільки не підлягає формалізації. Під час укладання реферату-інтерпретації оперують не текстом документу, а його змістом. Послідовність викладу інформації в рефераті може збігатися з послідовністю, прийнятій у тексті першоджерела, але не обов'язково; часто виклад здійснюється на основі узагальненого уявлення про першоджерело. Різновидом реферату-інтерпретації може бути автореферат дисертації.

Реферуванню підлягають такі документи:
- наукові статті (теоретичні, експериментальні, методичні, описові та ін.);
- розділи із книг (монографій, збірників праць і т. д.);
- патентні документи;
- депоновані рукописи [3].

Слід звернути увагу, що не всі документи можуть бути об'єктами реферування. Так, не підлягають реферуванню:
- стандарти;

- технічні умови;
- інструкції;
- прейскуранти;
- каталоги устаткування;
- довідкові видання (енциклопедії, словники, довідники);
- інформаційні та бібліографічні видання;
- тезауруси;
- класифікаційні схеми тощо [3].

### 2.2.3. *Функції реферату*

Реферат – багатофункціональний вторинний документ. Серед функцій, які виконує реферат, називають такі: інформативну, індикативну, науково-комунікативну, прогностичну, довідкову, адресну, індексування [5].

Особлива роль належить *інформативній* функції. З усіх вторинних документів саме реферат розкриває зміст первинного документа найповнішим чином, що дозволяє суттєво зекономити час під час роботи з відповідною науковою літературою.

*Індикативна* функція реферату полягає в тому, що він вказує на наявність відповідного документа, характеризує окремі елементи його змісту та висвітлює бібліографічні дані.

В певних випадках реферати можуть замінити первинні документи. Коли нема доступу до тексту першоджерела, читачі обмежуються ознайомленням із рефератами; реферат виступає в ролі основного засобу поширення інформації про нові досягнення в галузі науки й техніки, що свідчить про реалізацію *науково-комунікативної* функції.

*Прогностична* функція має місце, якщо реферати охоплюють основний потік документів певної галузі за значний проміжок часу, що дає змогу прогнозувати подальший розвиток цієї галузі.

За використання рефератів можна отримати необхідні довідки – *довідкова* функція. Користуючись рефератами, читач здійснює пошук довідкової та фактографічної інформації.

Наявність бібліографічного опису в складі реферату забезпечує виконання *адресної* функції. Особливу роль відіграють реферативні журнали, оскільки містять реферати первинних документів, що дозволяє користувачам ознайомитися з великою кількістю вітчизняних та зарубіжних джерел.

Реферати також виконують *сигнальну* функцію, оскільки повідомляють про вихід у світ першоджерела.

Слід підкреслити, що кожен реферат виконує й інформативну, й індикативну функції, але одна з них переважає, що дає можливість зарахувати його до групи індикативних або інформативних рефератів.

### 2.2.4. Структура реферату

Структура реферату залежить від його виду, вибору відповідних мовних і стилістичних засобів. У процесі написання тексту реферату відбувається пошук і синтез необхідної інформації, компонування окремих елементів для забезпечення послідовного, лаконічного, точного викладу основного смислового змісту первинного документа. Таким чином досягається зв'язність і чіткість подачі інформації.

Основні пункти, що має містити реферат, є такими:

*1. предметна рубрика.* У цьому пункті вказується область або розділ знань, до якого належить матеріал, що реферується;

*2. тема реферату*, тобто більш вузька предметна співвіднесеність першоджерел(а);

*3. вихідні дані джерел(а),* тобто прізвище та ініціали автора, заголовок, назва видання (книги або журналу), місце видання, рік, том, номер або дата випуску, сторінки, мова публікації. Всі дані надаються спочатку мовою оригіналу, нижче наводиться їх переклад;

*4. головна думка матеріалу, що реферується.* Зазвичай у самому джерелі головна думка стає ясною після прочитання всього матеріалу. У рефераті з неї починається виклад змісту. Вона передує всім висновкам та доказам. Послідовність викладу необхідна для того, щоб зорієнтувати читача відносно основного змісту джерела та його перспективної цінності. Референту треба вміти стисло сформулювати головну думку першоджерела, не додаючи власних коментарів;

*5. виклад змісту.* Зміст може викладатися в послідовності оригіналу за розділами, параграфами. Зазвичай формулюється питання, після нього надається висновок та необхідні докази. У цьому випадку для забезпечення зв'язності основних моментів із тексту оригіналу запозичують деякі сполучники та певні звороти. Але логіка викладу може не збігатися з логікою викладу в першоджерелі. Тоді референт додає до тексту сполучники та необхідні звороти (за необхідності – речення), що відсутні в мові оригіналу, які допоможуть якомога краще розкрити зміст першоджерела;

*6. висновки автора.* В переважній більшості випадків висновки автора відповідають головній думці. Якщо ж висновки автора в оригіналі відсутні, то й цей пункт реферату не потрібен;

*7. коментар референта.* Цей пункт реферату може бути лише у випадках, коли референт достатньо компетентний із викладених питань та може надати кваліфіковане судження про зміст. До коментарю належить критична характеристика першоджерела, актуальність висвітлених питань, судження про ефективність запропонованих рішень, рекомендації щодо призначення матеріалу, що реферується.

### 2.2.5. Загальні вимоги до написання рефератів

До основних вимог, що пред'являють до написання рефератів, належить, насамперед, його здатність дати читачеві загальне уявлення про характер першоджерела та його зміст.

Схарактеризуємо низку інших *вимог*:

*1. об'єктивність* – полягає, у першу чергу, у тому, що як відбір матеріалу для реферування, так і виклад сутності роботи, обсяг реферату, ступінь деталізації тощо мають визначатися теоретичним та практичним значенням тексту, який підлягає реферуванню, а не особистими поглядами або науковою зацікавленістю референта. Завдання референта – чітка, лаконічна та об'єктивна інформація про зміст роботи, а не її критичне рецензування;

*2. повнота реферату* – правильне відображання сутності та змісту публікації, яка реферується, відповідність до обсягу, призначення та характеру роботи, точність в передачі її змісту;

*3. єдність форми,* під якою розуміють стиль реферату та його термінологію. Особливу важливість набуває дотримання єдності термінів та позначень.

Обсяг реферату визначається обсягом першоджерела, нормами, встановленими для референтів, і практичним значенням конкретного документа. Середній обсяг має бути таким:

- для індикативних рефератів – від 500 друкарських знаків;
- для інформативних рефератів – 1000 друкарських знаків;
- для оглядових рефератів – 2500–10000 друкарських знаків.

Згідно з загальносхваленою науковою практикою, оптимальний обсяг реферату знаходитися в середньому в межах 1/8, 10–15 % обсягу першоджерела (хоча, можливо здійснення більшого ступеню компресії тексту).

### 3. Автоматизація анотування та реферування

У результаті розвитку теоретичних та експериментальних досліджень з автоматизації анотування та реферування було чітко окреслено два напрями:

1) дослідження, в яких за допомогою алгоритмічних методів робляться спроби екстрагувати з першоджерела найбільш інформативні фрагменти тексту та формувати з них реферати або анотації;

2) дослідження, які дозволяють виявити в тексті найбільш інформативні фрагменти та потім синтезувати з них нові реферативні тексти.

Більшість здійснених досліджень належать до першого напряму, яке називається автоматичним екстрагуванням. Другий напрям базується на першому та слугує його подальшим розвитком. Він передбачає перехід на більш високий рівень згортання: від екстрагування до перефразування.

За автоматичного екстрагування згортання тексту відбувається на основі певних алгоритмів за посередництва обчислювальної техніки. Отримані таким чином вторинні документи називаються екстрактами (квазірефератами, машинними рефератами, квазіанотаціями тощо).

### 3.1. Квазіреферування

Квазіреферування базується на екстрагуванні із первинних документів за допомогою певних формальних показників «найбільш інформативних» фраз (фрагментів), сукупність яких й утворює екстракт (квазіреферат). Порівняно з реферуванням, особливістю квазіреферування є те, що воно ґрунтується на аналізі поверхнево-синтетичних відносин у тексті, що не потребує звернення до глибинно-синтаксичних процесів, вивченість яких ще не достатня для опису іманентних властивостей будь-якого тексту.

У межах квазіреферування виділяють три основних напрями:

- *статистичні методи,* які базуються на використанні статистичних параметрів для оцінки інформативності різноманітних елементів тексту (слів, речень) перш за все за частотою, з якою слова трапляються у тексті;

- *позиційні методи,* які спираються на припущення, що інформативність речення знаходиться в залежності від його позиції (розташування) в тексті документа. Однак ці методи застосовуються лише у поєднанні з іншими методами, оскільки самі по собі не відзначаються необхідною репрезентативністю результатів;

- *індикаторні методи,* засновані на функціональній ідентифікації фраз первинного документа за допомогою індексації їх спеціальними словами – маркерами, індикаторами та коннекторами, що утворюють лексичний апарат даного способу екстрагування.

### 3.2. Формалізоване екстрагування

Формалізоване екстрагування знаходиться, умовно кажучи, десь посередині між традиційним ручним згортанням текстів першоджерел та автоматизованим, що відбувається за допомогою обчислювальної техніки. На думку деяких дослідників, використання комп'ютерних технологій стикається з чималими труднощами саме під час вирішення семантичних завдань, зокрема під час анотування та реферування. Труднощі обумовлені складністю, а в деяких випадках і неможливістю формалізації та алгоритмізації мисленнєвих процесів, які супроводжують ці процеси під час їх виконання в традиційному «ручному» варіанті. Вважають, що якість машинної обробки інформації не може бути вищою за якість інтелектуальної обробки, оскільки «мови та алгоритми, що допомагають машині "мислити", завжди будуть бідніші за природну мову та алгоритми, якими мислить людина».

Формалізоване екстрагування базується на такому припущенні: засоби вираження метаінформації в текстах першоджерел фіксуються, наприклад, у вигляді словника або списку словесних кліше (маркерів). Якщо за допомогою

цього словника вибрати з тексту марковані речення та укласти з них реферати та/або анотації (квазіреферати, квазіекстракти), то отримані вторинні документи за своїми якостями не поступатимуться традиційним рефератам та анотаціям.

До лексичного апарату згортання тексту за використання формалізованого методу зараховують *маркери, індикатори та коннектори*.

*Маркери* (їм належить основна роль) – це слова та словосполучення, які однозначно визначають смислові (змістові) аспекти тексту. Наприклад, такий аспект першоджерела, як «Настанова», характеризується маркерами: «Метою …є», «Завдання … полягає» тощо.

*Індикатори* – лексичні одиниці, які виконують переважно модально-оцінну функцію. На відміну від маркерів, вони не прив'язані до певного змістового аспекту першоджерела; вони відображають ставлення автора до питання, викладеного в документі, наприклад: «Треба підкреслити…», «Слід зазначити…».

*Коннектори* – лексичні одиниці, які забезпечують міжфразові зв'язки. Коннектори слугують для виразу таких логіко-смислових зв'язків, як причина – наслідок, імплікація, позитивна та негативна аргументація тощо, наприклад: «відповідно», «в результаті». У вітчизняному реферуванні розрізнюють так звані «ліві» коннектори, які відсилають до попередньої фрази (*аналогічний, даний, цей* тощо) та «праві», які потребують приєднання фрази, що наведена нижче (*крім того, зокрема* тощо).

Методика формалізованого екстрагування поєднує такі етапи:
1.	У тексті документу підкреслюються фрази, які містять маркери, та вносяться до тексту реферату-екстракту.
2.	Якщо марковане речення містить «ліві» коннектори, то робиться «крок назад» та підкреслюється попереднє речення. У цьому випадку до реферату вносять два речення.
3.	Якщо після маркованого речення розміщено уточнюючу фразу, яка містить «правий» коннектор, то робиться «крок вперед» та, відповідно, підкреслюється речення з коннектором. У цьому випадку до реферату вносять два речення – з маркером та коннектором.

За даними експериментальних досліджень, формальні методи екстрагування доречно застосовувати у випадку з реферуванням науково-технічних та інформаційних текстів (новинних дописів). На основі даних вітчизняних дослідників розроблено алгоритм реферування англомовних текстів (див. частину II).

## 4. Анотаційний та реферативний переклад як різновиди науково-технічного перекладу

Окрему увагу заслуговують такі види діяльності, як анотаційний та реферативний переклади. Згідно з думкою провідних фахівців, існують певні відмінності між анотуванням та/або реферуванням та виконанням анотаційного та/або реферативного перекладу. Так, під час анотування та/або

реферування відбувається смислове згортання без міжмовного перетворення, в той час як анотаційний та/або реферативний переклади поєднують два процеси: власне анотування та/або реферування та переклад. Схарактеризуємо кожний із цих видів перекладу.

## 4.1. Анотаційний переклад

*Анотаційний переклад* – це різновид технічного документа, що полягає в укладанні анотації оригіналу мовою перекладу.

Обсяг анотаційного перекладу порівняно з оригіналом визначається або замовником, або редактором, але зазвичай не перевищує 500 друкованих знаків.

Цей різновид перекладу відрізняється від інших різновидів технічного перекладу тим, що на другому етапі процесу перекладу – етапі усвідомленого запам'ятовування та відтворення – відбувається неповний синтез за умови повного аналізу.

Стиль анотаційного перекладу відрізняється відносною свободою викладу та визначається лише метою перекладу – надати стислу характеристику оригіналу.

За анотаційного перекладу відтворюється лише незначна частина інформації, яка міститься в оригіналі.

## 4.2. Реферативний переклад

*Реферативний переклад* належить до скорочених варіантів перекладу, який передбачає неповну передачу змісту оригіналу. Серед інших різновидів «неповного» перекладу – анотаційний, аспектний, фрагментарний – реферативний переклад уважають найбільш ефективним способом обробки іншомовного першоджерела, який дозволяє ознайомитися з його основним змістом.

Існує декілька тенденцій до розуміння поняття реферативного перекладу та, відповідно, розмаїття підходів до його виконання. Так, прихильники однієї точки зору вважають, що це – реферування тексту, що вже було перекладено. Згідно з іншим підходом, реферативний переклад визначають як повний переклад заздалегідь відібраних частин тексту, які складають зв'язний текст, тобто разом утворюють реферат оригіналу. Згідно з найбільш поширеним визначенням, реферативний переклад – це різновид перекладу, за якого відбувається згортання основного змісту вихідного тексту засобами мови перекладу. Все більшого поширення набуває розуміння реферативного перекладу як особливого різновиду мовномисленнєвої діяльності, в якому ані переклад, ані реферування не існують окремо. Операції перекладу тісно пов'язані з мисленнєвими операціями, що забезпечують згортання тексту. При цьому саме згортання є домінуючим процесом, оскільки ці процеси починають функціонувати на перших етапах осмислення та розуміння іншомовного тексту, а переклад вже підключається на етапі формування попередніх результатів та їх подальшого осмислення.

Особливістю реферативного перекладу є наявність особливого етапу, що являє собою результат осмислення та розуміння тексту в цілому, який фіксується у пам'яті у вигляді цілісного мисленнєвого утворення. Таке мисленнєве утворення не отримає будь-якої експліцитної форми, але ж саме воно лежить в основі утворення тексту реферату. Тому реферат має бути не тільки результатом скорочення вихідного тексту, а результатом його смислового перетворення, обов'язковим етапом якого є смислове згортання.

Текст реферативного перекладу – це семантична згортка, яка не зберігає мовну форму вихідного тексту, а лише його зміст. Обирання елементів змісту першоджерела, а також методів семантичного згортання обумовлюються насамперед вимогами кінцевих споживачів реферативного перекладу, його цільовою аудиторією.

Поняття цільового перекладу є основою так званої скопос-теорії, що виникла у науці про переклад в Західній Німеччині у 70-ті рр. минулого століття, авторами якої є відомі німецькі перекладознавці К. Райс та Х. Фермеєр. Формування скопос-теорії означало перехід від домінуючої концепції перекладу, де ключовим було поняття еквівалентності, до функціонально орієнтованої, де центральне місце належить саме меті перекладу. Саме функціональний підхід привів авторів теорії до поняття «скопосу» на позначення саме мети будь-якої діяльності. На позначення мети перекладу було запозичене грецьке слово «scopos», яке стає провідним у межах нової теорії перекладу, де переклад аналізують як вид практичної діяльності, що має певну мету. Основна ідея функціонального підходу полягає в тому, що процес перекладу визначається не вихідним текстом, не його комунікативним ефектом у вихідній лінгвокультурі, а функцією, яку текст перекладу має виконувати в новому соціокультурному середовищі. Усі різновиди «неповного» перекладу можна вивчати з позицій функціональних підходів. Відповідно, тексти анотаційного та реферативного перекладу мають бути адекватними перш за все до тієї комунікативної ситуації, де вони будуть функціонувати. Таким чином, у процесі виділення головного змісту перекладач має враховувати особливості цільової аудиторії, насамперед професійні потреби та інтереси замовників.

# ЧАСТИНА II

## ПРАКТИЧНІ РЕКОМЕНДАЦІЇ ПЕРЕКЛАДАЧАМ ЩОДО АНОТУВАННЯ ТА РЕФЕРУВАННЯ

Практичні рекомендації цього розділу мають на меті не тільки ознайомити з методикою укладання анотацій та рефератів, а й надати певні поради щодо виконання анотаційного та реферативного перекладів англомовних текстів українською мовою.

Анотаційний та реферативний переклад нерозривно пов'язані з процесами анотування та реферування; виконання цих видів перекладу неможливе без вміння робити смислову компресію тексту. Нижче наводимо різні методи здійснення смислового згортання текстів, які стануть у пригоді перекладачеві залежно від насамперед функціонального призначення документа та вимог цільової аудиторії. Функціональні підходи до здійснення анотування та реферування, а також до виконання анотаційного та реферативного перекладів роблять можливим надання рекомендацій загального характеру.

### 1. Етапи роботи із укладання анотації та реферату

*Укладання анотації* являє собою суттєве згортання первинного документа. Робота зі складання анотації зазвичай охоплює наступні етапи:
- позначення найбільш ємних і вагомих положень і розділів роботи;
- виділення з вибраних положень тільки ключових моментів, їх скорочення, перефразування так, щоб зміст цілого розділу можна було вмістити в одній змістовній фразі (послуговуючись ключовими словами);
- перечитування анотації двічі: вперше – задля скорочення, вдруге – задля відновлення необхідних втрачених елементів змісту.

*Укладання реферату* є смисловим згортанням первинного документа, яке поєднує такі етапи:

1) ознайомче читання, попередній аналіз. Вивчення реферованого документа починається з заголовка, довідкового апарату, рубрик у тексті, висновків і резюме. Основна мета оглядового аналізу полягає в здобутому враженні про первинний документ загалом, його проблематику і структуру;

2) уважне прочитання, поглиблений аналіз. Мета – детальне ознайомлення з первинним документом, виключення несуттєвих даних або елементів, щоб отримати чітке уявлення про об'єкт роботи, її властивості, мету твору, застосовані методи, основні результати й висновки автора, ступінь реалізації й галузі застосування даних із першоджерела.

Під час аналізу тексту відбувається оцінка важливості складників першоджерела з приводу доцільності їх використання в рефераті. Виділення ключових фрагментів складає перший етап інформаційної обробки тексту. Передусім до реферату вносять нові ідеї й гіпотези, експериментальні дані, нові методики, оригінальні конструкції, якісно нові явища, процеси і т. д. Ця група

елементів підлягає максимальному відображенню в рефераті; тут допустимі лише текстові скорочення без втрати інформації. Щодо даних, які не є принципово новими (традиційні методи, загальновідомі формулювання, цифровий матеріал, аргументи, пояснення, приклади тощо), ця інформація може бути представленою в рефераті вибірково залежно від значення та мети реферату.

Наступним етапом є організація і перегрупування виділених фрагментів відповідно до їх тематичної спрямованості. Потім відбувається складання логічного плану тексту. Виділені ключові фрагменти спочатку виписуються (або підкреслюються) в тому порядку, в якому вони зустрілися в першоджерелі. Після цього вони групуються за тематичним принципом довкола декількох великих підтем, що розвивають головну тему тексту. Цей матеріал служить основою для складання реферату.

## 2. *План поаспектного аналізу документа під час реферування*

План поаспектного аналізу документа під час реферування включає в себе такі пункти:
- мета дослідження;
- запропонований варіант вирішення проблеми (або об'єкт і предмет розгляду);
- специфіка запропонованого варіанту вирішення проблеми;
- призначення чи галузь застосування дослідження;
- місце проведення дослідження;
- методи дослідження;
- експериментальна перевірка;
- результати;
- висновки;
- переваги застосування запропонованого варіанту вирішення проблеми;
- рекомендації.

Наведений план-макет є універсальним, придатним для реферування документів будь-якої галузі. Певні аспекти із наведеного переліку можуть бути відсутні, але послідовність викладу зберігається. Допускається включення до реферату додаткових даних: зазначення наявності та кількості ілюстрацій, таблиць, додатків, бібліографічних посилань [3].

## 3. *Основні способи реферативного викладу*

Під час написання рефератів рекомендується використовувати такі основні способи реферативного викладу:
- *цитування,* тобто дослівне відтворення фрагментів первинного документа;
- *перефразування,* що передбачає часткову зміну (скорочення, об'єднання, заміну, згрупування та інші подібні процедури) окремих фрагментів тексту первинного документа;

- *заміщення* – заміна фрагменту тексту (речення загалом, його частини, словосполучення чи слова), якщо це не спотворює зміст документа;
- *опущення* – пропуск слова чи словосполучення без спотворення смислового змісту тексту реферату. Пропустити можна дані пояснювального характеру, роз'яснення чи ілюстрації до основних положень реферованого документа;
- *суміщення* – операція, за якої два чи кілька речень, де є подібні елементи, накладають одне на одне, утворюючи складну конструкцію, коли подібні компоненти використовуються лише один раз.

Ці операції часто виконуються на етапі редагування реферату [3].

### 4. Етапи виконання анотаційного перекладу

1. Знайомство з оригіналом, уважне прочитання тексту. На цьому етапі визначається основне питання (тема) оригіналу.
2. Укладання плану оригіналу. Слід відмітити найважливіші пункти (питання).
3. Опис змісту та будови оригіналу. Викладення змісту оригіналу у вигляді переліку основних питань.
4. Надання критичної оцінки оригіналу. На цьому етапі слід відмітити актуальність теми, призначення оригіналу.

### 5. Етапи виконання реферативного перекладу

1. Знайомство з оригіналом; перегляд спеціальної літератури задля ознайомлення з даною галуззю та її термінологією.
2. Розмічання тексту за допомогою квадратних дужок задля виключення його другорядних частин та повторів (виключені частини тексту беруться у дужки). Виключенню підлягають: несуттєві подробиці, опис попередніх експериментів, варіантів систем, посилання на інші роботи, що не стосуються безпосередньо змісту статті тощо.
3. Усунення можливих диспропорцій та незв'язаностей.
4. Повний письмовий переклад тієї частини оригіналу, що залишилася поза дужками, яка має бути зв'язним текстом, побудованим за тим самим принципом, що й оригінал. За наявності в оригіналі рисунків та іншого ілюстративного матеріалу відбирають лише найважливіші.

### 6. Приклади написання анотації та реферату й виконання анотаційного та реферативного перекладу

Нижче наводимо приклад компресії статті з оригінального джерела й оформлення анотації та реферату згідно з вимогами, що містяться в теоретичній частині. Абзаци заздалегідь нумеруємо задля аналізу процесу компресії тексту.

# HUNT FOR CAR BOMBS USING LASERS

*A system uses lasers to detect traces of explosives left on car door handles by would-be bombers*

1. AT SOME roadside checkpoints in Iraq there are still guards who will point a handheld device at people, cars and trucks in the hope its antenna will twitch to reveal the presence of a bomb. But the contraption doesn't work; it's just a radio aerial swinging on a handle. Unfortunately, the message about its deadly ineffectiveness hasn't reached all its users.

2. Last week, James McCormick, whose company made £50 million selling the fake bomb detectors for up to £27,000 each, was jailed for 10 years for what a judge at London's Old Bailey called a "callous confidence trick" that resulted in dozens of deaths after cars containing bombs were waved through checkpoints where the device was being used to screen for explosives.

3. But there is some good news in the field of bomb detection. As McCormick was being jailed, the European Commission's innovation arm announced the successful creation of a much more believable bomb-sniffing device. Created by a consortium funded by the EC, the portable laser rig is claimed to detect as little as 1 microgram of explosives from up to 20 metres away.

4. "No other research organisation or company has to date achieved similar breakthrough results," says Paul Codd, a spokesman for the project, known as Optical Technologies for the Identification of Explosives (OPTIX).

5. The system works by firing laser pulses at objects like door handles, windows, luggage or steering wheels to detect the traces of explosives that would-be bombers leave behind after handling bombs. It can be mounted in a van or on a mobile robot.

6. Just a few years ago, such an announcement would have been met with scepticism worthy of McCormick's bomb-dowsing device. The problem was that, outside of pristine lab conditions, available laser technology was foiled by the presence of environmental contaminants.

7. OPTIX gets around this by combining two methods that didn't work alone: laser-induced breakdown spectroscopy (LIBS) and Raman spectroscopy. In LIBS, a high-energy laser is fired at a target – a suspicious car door handle, say. This causes any residue to turn into a plasma that emits certain wavelengths of light, which reveal the elements in the residue. The molecular makeup of a residue can be worked out using the Raman technique, because the laser induces vibrations that are unique to each chemical compound. Combining the two pieces of information allows technicians to work out if the residue is from an explosive.

8. As one might expect, it isn't without risk. "Caution is required when directing laser beams at explosives, since a beam of sufficient intensity and appropriate wavelength can cause them to ignite or detonate," says Sidney Alford, founder of bomb disposal equipment maker Alford Technologies in Chippenham, UK. But he thinks OPTIX will be safe, if used carefully. "Provided the laser is aimed only at trace quantities of explosive, this problem should not arise," he says.

9. "The [new] trace explosives detector will increase security in all scenarios," says Alberto Calvo, a director at Indra Sistemas, part of the OPTIX consortium. But

given recent events, it might be worth withholding judgement until trials, now underway with police bomb squads across Europe, come back with unassailably positive results.

**Paul Marks**

Схарактеризуємо кожен з абзаців та підкреслимо головні інформативні відрізки.

**Абзац 1.** У цьому абзаці міститься опис проблеми – внаслідок недостатнього рівня інформованості триває застосовування непридатного пристрою для виявлення вибухових речовин.

1. AT SOME roadside checkpoints in Iraq there are still guards who will point a handheld device at people, cars and trucks in the hope its antenna will twitch to reveal the presence of a bomb. But the contraption doesn't work; it's just a radio aerial swinging on a handle. Unfortunately, the message about its deadly ineffectiveness hasn't reached all its users.

**Абзац 2** сповіщає про тяжкі наслідки, які спричинило використання фальшивого пристрою та про покарання особи, чия компанія отримала чималі прибутки від продажу підроблених детекторів.

2. Last week, James McCormick, whose company made £50 million selling the fake bomb detectors for up to £27,000 each, was jailed for 10 years for what a judge at London's Old Bailey called a "callous confidence trick" that resulted in dozens of deaths after cars containing bombs were waved through checkpoints where the device was being used to screen for explosives.

Вважаємо, що інформація щодо імені особи, терміну її ув'язнення та розміру прибутків компанії несуттєва для потреб замовника реферату, тому ми не включаємо її до вторинного тексту.

**Абзац 3** надає позитивну інформацію щодо створення надійного пристрою для виявлення бомб та коротко його характеризує.

3. But there is some good news in the field of bomb detection. As McCormick was being jailed, the European Commission's innovation arm announced the successful creation of a much more believable bomb-sniffing device. Created by a consortium funded by the EC, the portable laser rig is claimed to detect as little as 1 microgram of explosives from up to 20 metres away.

**Абзац 4** повідомляє про дослідницьку організацію – автора проекту зі створення детектора вибухівок. Звернемо увагу на абревіатуру, наведену в дужках.

4. "No other research organisation or company has to date achieved similar breakthrough results," says Paul Codd, a spokesman for the project, known as <u>Optical Technologies for the Identification of Explosives (OPTIX)</u>.

**Абзац 5** інформує про те, як працює система.

5. <u>The system works by firing laser pulses at objects</u> like door handles, windows, luggage or steering wheels <u>to detect the traces of explosives that would-be bombers leave behind after handling bombs</u>. <u>It can be mounted in a van or on a mobile robot</u>.

**Абзац 6** називає технічні труднощі, з яким зіткнулися розробники пристрою.

6. Just a few years ago, such an announcement would have been met with scepticism worthy of McCormick's bomb-dowsing device. <u>The problem was that, outside of pristine lab conditions, available laser technology was foiled by the presence of environmental contaminants</u>.

**Абзац 7** наводить шляхи подолання труднощів, згаданих у попередньому абзаці.

7. <u>OPTIX gets around this by combining two methods that didn't work alone: laser-induced breakdown spectroscopy (LIBS) and Raman spectroscopy</u>. In LIBS, a high-energy laser is fired at a target – a suspicious car door handle, say. This causes any residue to turn into a plasma that emits certain wavelengths of light, which reveal the elements in the residue. The molecular makeup of a residue can be worked out using the Raman technique, because the laser induces vibrations that are unique to each chemical compound. Combining the two pieces of information allows technicians to work out if the residue is from an explosive.

Найважливіша інформація наведена в першому реченні, яке ми й виділили. Подальші речення розкривають сутність застосування спектроскопії збудження лазерним пробоєм та Рамановської спектроскопії. Вважаємо, що замовник реферату обізнаний зі вказаних питань, тому ці деталі до тексту реферату не включаємо.

**Абзац 8** застерігає щодо можливих негативних наслідків, до яких може призвести використання лазерного пристрою.

8. As one might expect, it isn't without risk. "Caution is required when directing laser beams at explosives, since a beam of sufficient intensity and appropriate wavelength can cause them to ignite or detonate," says Sidney Alford, founder of bomb disposal equipment maker Alford Technologies in Chippenham, UK. But he thinks OPTIX will be safe, if used carefully. "Provided the laser is aimed only at trace quantities of explosive, this problem should not arise," he says.

**Абзац 9** наводить позитивні наслідки використання детектора.

9. "The [new] trace explosives detector will increase security in all scenarios," says Alberto Calvo, a director at Indra Sistemas, part of the OPTIX consortium. But given recent events, it might be worth withholding judgement until trials, now underway with police bomb squads across Europe, come back with unassailably positive results.

Задля укладання реферату використовуємо всі способи реферативного викладу – цитування, перефразування, заміщення, опущення, суміщення. В результаті отримуємо текст реферату:

Failure to reveal the explosives caused by using the fake bomb detectors resulted in dozens of deaths after cars containing bombs were waved through checkpoints in Iraq. Therefore, the European Commission launched a project known as Optical Technologies for the Identification of Explosives (OPTIX) aimed at creating a much more successful bomb-sniffing device. The portable laser rig that can be mounted in a van or on a mobile robot is claimed to detect as little as 1 microgram of explosives from up to 20 metres away. The system works by firing laser pulses at objects like door handles, windows, luggage or steering wheels to detect the traces of explosives that would-be bombers leave behind after handling bombs. Developing the device, the designers faced with the following problem: contamination outside of pristine lab conditions foiled the available laser technology. They managed to cope with the problem above by combining two methods that didn't work alone: laser-induced breakdown spectroscopy (LIBS) and Raman spectroscopy. Using the detectors requires caution since directing laser beams of sufficient intensity at explosives can cause them to ignite or detonate. However, if used carefully, the device will increase security in all scenarios.

Варіант компресії та, відповідно, текст реферату може бути відмінним від запропонованого, що цілком залежить від потреб замовника.

Наведімо приклад анотації англійською мовою:

Abstract

The article describes an explosive detector created by a consortium funded by the EC. The design features, the principle of operation of the device as well as the

reasons of its development are presented. The technical challenges and the advantages of its using are briefly touched upon.

На основі виконаної компресії тексту й укладених реферату та анотацій англійською мовою наведімо їх відповідники українською.

## Реферат

Використання непридатного до експлуатації детектора вибухових речовин спричинило неспроможність виявити вибухівки на автомобілях, які перетинали контрольно-пропускний пункт, що призвело до загибелі десятків людей в Іраку. Отже, Європейська комісія започаткувала проект під назвою «Оптичні технології задля ідентифікації вибухівок» (ОПТІВ), метою якого є розробка більш вдалого «бомбошукача». Стверджують, що портативний лазерний пристрій, який можна прикріпляти до фургона або до мобільного робота, здатний розпізнати до 1 мкг вибухівки на відстані до 20 м. Система працює шляхом стріляння лазером по об'єктах (ручки дверей, вікна, багаж або кермо автомобіля) задля розпізнавання залишків вибухових речовин, які потенційні терористи залишають після тримання бомб. Під час роботи над пристроєм команда розробників зіткнулася з проблемою забруднення лазеру за межами лабораторії. Але спеціалістам вдалося впоратися зі вказаною проблемою шляхом застосування двох методів, які не спрацьовують поодинці: спектроскопія збудження лазерним пробоєм та Рамановська спектроскопія. Використання детекторів вибухівок потребує обережності, оскільки направлення лазерних променів достатньої інтенсивності на вибухові речовини може спричинити їх загоряння або вибух. Однак, якщо дотримуватися правил безпеки, застосування детекторів значно поліпшить стан справ у всіх сферах.

## Анотація

[Полювання лазером на бомби в автомобілях]. Hunt for Car Bombs Using Lasers. Marks P. «New Scientist», 2013, № 2916 (англ.).

Повідомляється про розробку детектора вибухових речовин за фінансування Комісією Євросоюзу. Наводяться технічні характеристики та принцип дії пристрою, а також причини його розробки. Коротко наголошуються технологічні труднощі та переваги його застосування.

Нижче наведімо приклад виконання реферату за допомогою методу формально-синтаксичного аналізу та алгоритм, за використання якого було отримано реферат.

*7. Алгоритм реферування інформаційного повідомлення методом формально-синтаксичного аналізу:*

- Нумеруємо речення тексту.
- Переміщуємо до реферату перше речення тексту.
- У кожному наступному реченні тексту шукаємо та підкреслюємо коннектори, що вказують на логічний зв□язок між цілими реченнями, або логіко-смислові коннектори (див. додаток).
- Якщо логіко-смисловий коннектор знайдено, перевіряємо, яку функцію він виконує: чи поєднує речення з одним із попередніх речень (тобто чи він «істинний»), чи поєднує дві частини даного речення (тобто чи він «хибний»). Якщо коннектор істинний, то номер даного речення підкреслюємо.
- Якщо логіко-смисловий коннектор не знайдено, шукаємо в ньому коннектори, що вказують на зв□язок між об'єктами (вказівний або особовий займенник, або означений артикль у функції «істинного» коннектора) (див. додаток). Якщо їх знайдено, підкреслюємо номер цього речення.
- У кожному реченні шукаємо слово «загального» значення (див. додаток). Якщо таке слово знайдено, підкреслюємо номер цього речення.
- Якщо маємо підряд групу речень із непідкресленими номерами, то підкреслюємо номери всіх речень даної групи, крім першого. Якщо в результаті виявилося, що кількість непідкреслених речень значно менша за загальний обсяг тексту, то дану операцію можна не здійснювати.
- Речення з непідкресленими номерами складають реферат.

Проілюструємо даний алгоритм на тексті, що наведено нижче. Речення тексту нумеруємо:

## IRAN CONDEMNS TOUGHER US OIL SANCTIONS BILL PASSED BY HOUSE

*US legislation dampens hopes of a diplomatic breakthrough in dispute over Iran's nuclear programme.*

1. Iran has dismissed a sanctions bill approved by the US House of Representatives that toughens existing measures imposed on Tehran over its disputed nuclear programme.

2. Despite fears the new legislation could thwart hopes for a diplomatic breakthrough in the wake of Hassan Rouhani's election victory, the lower house of the US Congress overwhelmingly passed the sanctions to further limit the Islamic republic's access to the global market for its oil exports and punish rebellious customers who continue to buy Iranian crude.

3. "We have no doubts that sanctions is a failed policy," said Iran's foreign ministry spokesman, Abbas Araqchi, according to quotes published by the website of the state-run broadcaster IRIB. 4. "Sanctions and intensifying them … will only make the nuclear issue more complex and more difficult to resolve," he added.

5. Critics of the bill <u>said</u> <u>tougher sanctions</u> could not have come at a worse time given that Rouhani will be inaugurated on Sunday and has not yet had the chance to compromise. 6. <u>But</u> those who supported the legislation <u>said</u> the new Iranian president would have little say with regards to Tehran's nuclear policy, which is in the hands of the supreme leader, Ayatollah Ali Khamenei.

7. Tehran's nuclear trajectory has experienced considerable shifts during previous administrations in Tehran. 8. Under the reformists in 2003, when Rouhani was the chief nuclear negotiator, Iran for the first time agreed to halt its enrichment of uranium and allow more scrutiny of its facilities by international inspectors.

9. <u>The bill</u> will have to be voted on by the US Senate in September after summer recess and signed by Barack Obama before it comes into effect.

10. John Boehner, the Republican speaker of the house, and Nancy Pelosi, the Democratic leader, both <u>spoke</u> in favour of the measure, which was passed by 400 votes to 20. 11. <u>Boehner told</u> representatives that Iran was a "global menace", and <u>Pelosi said</u> sanctions should be kept in place because they had had an impact.

12. Some analysts fear <u>the bill</u> might play into the hands of hardliners in Tehran who say negotiations with the west are futile. 13. Rouhani won the presidential election in June on promises of moderation and improved relations with the international community.

14. <u>The bill also</u> highlights a rift between the White House and Congress over the US's Iran policy. 15. <u>The Obama administration</u>, which does not appear to believe Iran's leaders have decided to make a nuclear bomb just yet, <u>says</u> it is willing to continue negotiations and recently sent a positive signal to Tehran by easing restrictions on medicine and medical devices.

16. Rouhani is expected to name Mohammad Javad Zarif as Iran's new foreign minister, in a move seen as Tehran's olive branch to Washington.

17. Russia <u>said the new bill</u> would not help the nuclear negotiations. 18. <u>"Any additional sanctions are actually aimed at the economic strangulation of Iran, but not at solving the problem of non-proliferation," its deputy foreign minister, Gennady Gatilov, told Russia's Interfax news agency</u>. 19. <u>"What has been done through the security council is quite adequate and sufficient."</u>

20. Jim McDermott, a Democrat representative for Washington state who <u>spoke against the bill,</u> <u>said</u> it would undermine efforts to resolve the nuclear dispute with Iran. 21. <u>"It's a dangerous sign to send and it limits our ability to find a diplomatic solution to nuclear arms in Iran," he said.</u>

22. Jamal Abdi, policy director at the National Iranian American Council, echoed McDermott, <u>saying: "The Iranian people sent a clear message in recent elections that they support moderation over radicalism, but that message has fallen on deaf ears among House leadership</u>. 23. <u>"By forcing this vote before the US has an opportunity to engage with Iran's incoming government, the House risks squandering a major opportunity and only makes a nuclear deal more difficult to achieve."</u>

(1 August 2013 http://www.theguardian.com)

Реферат складають речення 1, 2, 7, 8, 13, 16. Залежно від потреб замовника речення 13 та 16 можна не включати до реферату. У результаті

використання формально-синтаксичного методу компресії першоджерела отримаємо реферат:

1. Iran has dismissed a sanctions bill approved by the US House of Representatives that toughens existing measures imposed on Tehran over its disputed nuclear programme. 2. Despite fears the new legislation could thwart hopes for a diplomatic breakthrough in the wake of Hassan Rouhani's election victory, the lower house of the US Congress overwhelmingly passed the sanctions to further limit the Islamic republic's access to the global market for its oil exports and punish rebellious customers who continue to buy Iranian crude.

7. Tehran's nuclear trajectory has experienced considerable shifts during previous administrations in Tehran. 8. Under the reformists in 2003, when Rouhani was the chief nuclear negotiator, Iran for the first time agreed to halt its enrichment of uranium and allow more scrutiny of its facilities by international inspectors.

13. Rouhani won the presidential election in June on promises of moderation and improved relations with the international community. 16. Rouhani is expected to name Mohammad Javad Zarif as Iran's new foreign minister, in a move seen as Tehran's olive branch to Washington.

Отриманий текст можна використати для виконання реферативного перекладу українською мовою:

Іран не погоджується на ухвалений Палатою представників США законопроект, який запроваджує проти Тегерану більш жорсткі санкції, покликані зупинити ядерну програму.

Незважаючи на побоювання, що нове законодавство може зруйнувати надії на дипломатичний прорив після перемоги на виборах Хассана Рухані, переважна більшість представників нижньої палати Конгресу США затвердила законопроект про санкції щодо обмеження доступу Ісламської республіки до світового ринку експорту нафти. Крім цього, законопроект передбачає своєрідне покарання для тих покупців, які продовжуватимуть придбавати іранську сировину.

Ядерна програма Тегерану зазнала значних змін за часи попередньої адміністрації. Під час правління реформістів у 2003 р., коли Рухані був основним посередником під час переговорів з питань ядерної програми, Іран вперше погодився припинити збагачення урану та надати змогу міжнародним наглядачам зробити ретельне вивчення власних виробничих потужностей.

У червні Рухані виграв президентські вибори завдяки обіцянкам вести помірковану політику та поліпшити стосунки з міжнародною спільнотою. Очікується, що Рухані призначить на посаду голови зовнішньополітичного відомства Мохаммада Джавада Зарифа з метою покращити відносини між Тегераном та Вашингтоном.

## ТЕКСТИ ДЛЯ АНОТУВАННЯ ТА РЕФЕРУВАННЯ

### TECHNOLOGY

**Text 1**

### GOOGLE GLASS HAS ITS ELECTRONIC EYE ON HEALTH

by Paul Marks

The experimental Google Glass headset has already inspired innovators to create applications that could bring big changes to healthcare.

"SO, WHY are you wearing Google Glass?" I ask the man ahead of me in the coffee line at Ubicomp, a computing conference in Zurich, Switzerland. He responds enthusiastically that he is trying to work out how people with diabetes could use Glass's camera to recognise the nutritional value of the food they eat and use that to predict their glucose levels, helping them better cope with their condition.

The wearer is Subrai Pai of the Georgia Institute of Technology in Atlanta, and his idea is just one of many healthcare applications for Glass. The camera-packing wireless eyepiece is also helping people to live with some of the problems of paralysis, blindness and deafness. And surgeons are eyeing Glass as a tool for improving surgery and medical education.

Last month, Christopher Kaeding, a surgeon at Ohio State University in Columbus, strapped Glass on before performing a knee operation to repair a patient's anterior cruciate ligament. As he went through the procedure, colleagues across town were able to view the action from Kaeding's point of view – by virtue of a Google Hangouts online forum – and offer advice, while medical students in yet another location watched and learned.

Beyond the operating theatre, Glass could be useful to people with sensory impairments. A blind person preparing to cook and wondering what's in a food tin could easily find out by taking a picture of the label and sending it, with a question, to crowd workers on Amazon's Mechanical Turk using a system developed by researchers at Carnegie Mellon University in Pittsburgh, Pennsylvania, and at the University of Maryland in Baltimore.

"Back comes a result in seconds saying 'no, the can does not contain nuts'. Or 'flip the box around, you're looking at the wrong side'," says Thad Starner, of Georgia Tech, who is Google's technical lead for Glass. "This technology also helps with things you just don't even think about as a sighted person, like is there a rash on my baby's head?"

Starner is also working with people with paralysis of all four limbs to see how Glass can help them. For instance, Glass makes a sound that is conducted through your cheekbone to signal the arrival of a text or email, which can be sent from your phone via Bluetooth or over Wi-Fi. A tilt of the user's head, or a wink, tells Glass's sensors to display the message. "They can then respond by voice and their words are sent to Google servers, converted to text and transmitted as SMS faster than their friends can text," says Starner.

Starner tells of a quadriplegic woman who has been empowered by Glass to act as navigator and videographer on camping trips with friends – using Glass's heads-

up, turn-by-turn satnav and its built-in camera. "Glass is reducing some of the barriers to such participation," he says.

The aim of Pai's project is to let people with diabetes view all of their health data in a simple Glass visualisation. "This could include data from insulin pumps, continuous glucose monitors, pedometers, heart-rate monitors and nutrition information from a food journal captured via Glass's camera," says Pai's colleague Nate Heintzman, who runs the project at the University of California, San Diego. He admits that the system is not yet ready to perform automated food-recognition but says that simply having data in one place will help users make better health decisions. The benefits extend to more than just those who live with impairments. For parents learning to communicate with deaf children, Georgia Tech researcher Kim Xu has developed SmartSign, an app demonstrated by Starner at Ubicomp, that allows a child's hearing family to ask for the sign language of a particular word and have a short video "microlesson" on that subject streamed to the Glass screen.

Google is not saying when Glass will become an affordable consumer product, but when it does, a raft of health applications await it. Sensors that measure heart arrhythmias are already being built into clothing by researchers like Lucy Dunne, a smart-textiles designer at the University of Minnesota in St Paul. It is likely that Glass will connect with such sensors to record and display their data.

Despite the technical wizardry, the trickiest problem Google faces, says Dunne, is the same one that faces makers of all wearable technologies: making Glass into something that people actually want to wear. That will mean making Glass look a lot more attractive than its current uber-geeky look. "People want to look normal. So you have to innovate within subtle conformity restraints and aesthetics," she says. "Fashion is hard."

**The Glass 2.0 wish list**

Google Glass has a mic and camera, plus sensors for motion, orientation, proximity and eye winks, but a few more gizmos would really up its game.

So says Bernard Kress of GoogleX, the lab in Mountain View, California, where Glass is being developed. Top of his wish list is adding a Kinect-style depth camera to allow Glass to recognise its wearer's gestures, such as finger clicks and hand waves, to activate functions like sharing pictures quickly online. But he says he is still waiting for depth cameras to miniaturise enough.

Meanwhile, Japanese mobile network NTT DoCoMo has developed a way that a Glass-type headset could capture your face for video calls. Using four tiny fisheye video-camera lenses aimed at a user's face from the headset's edges, four distorted images of your face can be captured, corrected and stitched together to create a full-motion selfie to be transmitted with your voice.

Kai Kunze at Osaka Prefecture University in Japan hopes Glass 2.0 comes with a gaze-tracking sensor. He has created an algorithm that logs your reading habits by watching for eye-movement patterns that differ when reading comics, newspapers, fashion magazines, textbooks or novels. It tots up your intake and warns you if you read too much junk.

(27 September 2013 New Scientist www.newscientist.com)

Text 2

# 3D-PRINTED OBJECTS OUTGROW THEIR PRINTERS

by Niall Firth

3D printing may be set to change the world by letting us make all sorts of bespoke objects, but there's one little problem: the printers can only print items smaller than themselves. Until now, that is.

Skylar Tibbits at the Massachusetts Institute of Technology's Self-Assembly Lab and colleague Marcelo Coelho have come up with a way for standard 3D printers to print out large-scale objects. "It's challenging the notion that we always need a machine that's bigger than the thing it's printing," says Tibbits.

The approach, called Hyperform, converts the object to be printed into a single long chain made from interlocking links. An algorithm works out how that chain can be packed together into the smallest cube possible using a Hilbert curve – a fractal-based pattern that is the most efficient way of squeezing a single line into a small as space as possible. The resulting cube is small enough to be printed inside a standard printer.

## Hand assembly

Once this cube is printed, the chain can be unravelled and assembled by hand to create the desired object. That's possible because each link in the chain has notches that allow it to bend only in a certain way. "You have to fold it by hand and click it into place," says Tibbits. Hyperform won the "The Next Idea" prize at the Ars Electronica 2013 technology festival in Linz, Austria, earlier this month.

But printing cubes made of such densely packed chains was too much for most of the consumer printers that Tibbits and his team tried. "We blew a lot of printers at first," he says. So they teamed up with Formlabs who, after a successful Kickstarter crowdfunding campaign, have just started shipping their Form 1 3D printer.

The Form 1 is capable of much higher resolution than standard consumer 3D printers. Instead of printing out layer upon layer of plastic, it uses stereolithography, in which a pool of liquid plastic is added to the base of the printer and a laser traces out the pattern required, causing the liquid plastic to cure and solidify. The technique can form layers just 25 microns thick, with details as small as 300 microns.

Hyperform has so far been used to create large structures such as a chandelier, and Tibbits sees it as being perfect for producing large 3D-printed consumer products. But the Form 1 printer uses resins which have limitations in terms of strength. "There is a range of things that are largish that we can do right away," says Tibbits. "But if you want to make large-scale furniture or buildings, there needs to be an approach to make them stronger."

## 4D printing

Manually clicking each link into place isn't ideal either. That's where Tibbits' other work in so-called 4D printing might help. 4D printing uses materials that are 3D-printed to produce an intermediate object which, when exposed to water, will bend and twist itself into the final structure. "You can see how Hyperform and 4D printing are pointing towards each other," he says.

Clément Moreau, CEO of French 3D printing firm Sculpteo, says projects like Hyperform are shaping the future of 3D printing. "This is yet another example of how 3D printing is more of a flexible manufacturing process than injection moulding because it constantly opens up new possibilities in terms of materials used and shapes which can be printed."

<div align="right">(26 September 2013 New Scientist <u>www.newscientist.com</u> )</div>

**Text 3**

## FIRST NANOTUBE COMPUTER COULD SPARK CARBON REVOLUTION

<div align="right">by Jacob Aron</div>

COMPUTING, like life, may soon be carbon-based. A functioning computer has been built from carbon nanotubes – complete with its own operating system and software.

It is a simple device, made of only 178 transistors compared with the billions in today's silicon computers. And it is not the first time a computer has been made from something other than silicon.

But given the long-touted potential benefits of carbon nanotubes over silicon, it's a step that could spark a major revolution in computing, akin to the switch from vacuum tubes to silicon around 50 years ago.

"It's a simple computer, but it's not a trivial computer," says Subhasish Mitra of Stanford University in California, who led the development of the device with Philip Wong, also at Stanford.

The computer also represents a victory for much-hyped carbon nanotube transistors, created in 1998 by Cees Dekker and his group at Delft University of Technology in the Netherlands. "It is wonderful to see such a carbon nanotube computer realised, 15 years after our group discovered that carbon nanotube molecules could be used as the basic element of a computer," says Dekker.

Carbon nanotubes' electrical properties mean they make faster and more efficient transistors – the semiconducting switches that create logic gates and allow computation. But difficulties manipulating the tiny molecular rods left many asking if they would ever be useful.

Because they are so small, nanotubes can slip out of place and connect parts of a circuit that are not meant to touch. Mitra and his colleagues guided their tubes by growing them on a quartz wafer, aligning 99.5 per cent of them along the crystal's regular structure. Once the nanotubes were in place, they etched out any misaligned tubes.

The team also sent a large current through the circuit to burn out any useless metallic nanotubes and ensure that only semiconducting nanotubes were left behind (Nature, DOI: 10.1038/nature12502).

"Everybody says that nothing is manufacturable with nanotubes," says Mitra. "That question has been resolved."

Once it had a working chip, the team programmed it to run a counting program and a sorting algorithm. The computer can switch between the two programs,

allowing it to multitask like more sophisticated machines. Its basic design is what is known as Turing complete, which means the carbon nanotube machine can theoretically compute anything a regular PC can – just much, much more slowly. It runs at a speed of 1 kilohertz, millions of times slower than modern machines.

This raw speed is deceptive, though, says Mitra, because the experimental chip is hooked up to measurement equipment that slows it down. "If you take out the measurement side of things you would get significant speed-up."

The computer's mere existence is more important than its complexity, says Aaron Franklin, a researcher at IBM in New York who was not involved in the work. "It is a key milestone on the path towards a competitive carbon nanotube computer," he says.

Even once the technology is ready, high costs mean you are unlikely to see a carbon chip inside your laptop or smartphone any time soon, Franklin adds. They might show up first in the enormous servers run by the likes of Google and Amazon. "Servers are always going to benefit from improvements that help them have higher performance and run at lower power," he says.

(25 September 2013 New Scientist www.newscientist.com)

**Text 4**

**GPS ANTENNA FILTERS OUT NOISE TO BOOST URBAN ACCURACY**

by David Hambling

For something we rely on so heavily, GPS is pretty rubbish. In the open, it is accurate to within a few metres, but in built-up areas it frequently cannot even locate the correct city block. Now a new type of antenna promises to improve its accuracy in urban areas – even indoors.

The problem is multipath interference, the curse of all radio-based location systems. When signals from satellites are reflected off buildings navigation systems get confused.

"Multipath is the dominant source of interference for GPS in cities and indoors," says consultant David Last, former president of the UK's Royal Institute of Navigation. "Nothing else causes as much serious error."

Now VRay, a new type of antenna that eliminates multipath interference, has been developed by the US Air Force Institute of Technology and Locata Corporation of Canberra, Australia. It is based on Locata's previous work with ground-based positioning technology.

VRay is a "beam-forming" antenna that combines the signal from an array of receiving elements to identify and subtract multipath and other interference to extract a clean signal. The antenna scans for millions of virtual beams a second, which helps it differentiate the valid GPS signal from the rest of the clutter, says Locata's CEO Nunzio Gambale.

Previous beam-forming antennae have been large and expensive, with a separate radio receiver for each antenna element. VRay has a single receiver that switches at high speed between dozens of elements.

"The concept of beam-steering for GPS is well known. However, its use has been mainly confined to the military due to the high cost. Locata's breakthrough is to time-multiplex the receiver," says Last.

This design means VRay will be much smaller, cheaper and simpler than previous designs. Early VRay prototypes are still bulky, but the plan is to build antennas that are flush with airframes and vehicle roofs, and to create a portable version within a helmet.

(23 September 2013 New Scientist www.newscientist.com)

### Text 5

### FORGET PREMIUMS: A PEER-TO-PEER NETWORK WILL COVER YOU

by Hal Hodson

People can now insure one another in peer-to-peer networks and do away with big insurance companies and premiums

INSURANCE is an unfortunate fact of life. We pay large premiums to cover ourselves for bad events that often never happen. But there is another way. An online insurance firm called Peercover lets groups of people insure each other on their own terms and at a fraction of the cost.

Insurance is the latest financial service to get a shake-up from peer-to-peer (P2P) dynamics. Already, individuals can lend money for a return with interest. Similarly, people wanting to exchange currency can avoid banks and instead use P2P services to find other people looking to make the opposite trade.

"The changes in financial services that are happening now are happening more quickly and dramatically than anything we've seen over the last 100 years," says Ron Suber of peer-to-peer loan company Prosper. "Peercover is a great example."

P2P insurance is simpler and cheaper than mainstream methods. "People are paying profit and overhead to insurance firms when they pay premiums," says Peercover co-founder Jared Mimms. Peercover groups don't collect premiums. Instead, every individual in the group has a stake – each is both insurer and insuree. The group's founder sets the initial conditions for that group, including what can be insured and the maximum value of an item. The payout for a claim is split between all members but is only made when the majority of the group approve the claim. The amount you pay out is directly proportional to the value of the goods you have insured, as calculated by Peercover's algorithms. Someone insuring a $400 cellphone will pay a larger proportion of a member's claim than someone who is insuring a $100 cellphone, for example. Members who fail to pay are ejected from the group and are no longer covered.

The reason all this is possible is, as with other P2P services, because of the rise of new ways to pay online. "The kind of insurance we're interested in wasn't possible a few years ago," says Mimms. "It only became possible because of micropayments." Behind micropayments are breakthroughs such as the virtual currency Bitcoin and the payment network Ripple, which Peercover uses. Both charge an extremely small fee

for processing a transaction compared with traditional models such as credit card companies, making payments as low as 20 cents feasible.

Initially, Peercover's focus is on building groups to cover small things like cellphones, and what Mimms calls positive insurance. This is where a group pays out when a member reaches an agreed goal, such as giving up smoking. But he has grander visions too, such as health insurance, where large groups of Peercover users could negotiate preferential rates for treatment.

"The technology allows for the potential of collective bargaining in the negotiation of healthcare costs in which groups may band together to practise some of the bargaining techniques used by governments and traditional insurance behemoths," Mimms says.

Ellen Carney, an insurance industry analyst with research firm Forrester, says Peercover points towards the future of insurance. "It's very clever. This model is at the historical roots of so many insurance companies."

She backs the idea that Peercover has the potential to change how health insurance works in the US, although there are obvious regulatory hurdles. "Health insurance in the US has a lot of problems. You could see that this would be an interesting alternative."

Richard Carter, CEO of financial software developer Nostrum Group, says that data from sources such as social networks will play a role in a peer-to-peer world. This won't just be in the form of finding friends to go in with on coverage, but to judge unknown group applicants too.

"Consumers need to learn that everything they put into the public domain is going to be used to judge them in future, whether they like it or not," Carter says.

(22 September 2013 New Scientist www.newscientist.com)

**Text 6**

## FIRST SILICON PAPER USHERS IN ERA OF BENDY ELECTRONICS

by Jacob Aron

You won't find it at any office supplies shop. But silicon paper may be the key to building bendy versions of traditional microchips.

Nearly all modern gadgets, from smartphones to washing machines, use microprocessors based on silicon wafers. "Silicon is one of the most important semiconductors," says Chengxin Wang of Sun Yat-sen University in Guangzhou, China. "However, it is hard to achieve flexible and transparent electronics with silicon."

That's because silicon has a crystal structure that stops it from bending easily, and when it is sliced into thin wafers these components are brittle. That creates a problem for future bendable electronics , which could include roll-up displays and wearable devices.

**Nanowire network**

Wang and colleagues wondered if they could coax silicon into a more flexible form. They put silicon monoxide powder inside a crucible and vaporised it by heating it to 1600□°C.

The team then used a stream of argon gas to push the vapour to the top of the crucible, where it cooled to form particles of silicon and silicon dioxide. Some of the silicon stuck together and grew into a sheet of nanowires, entwined like fibres inside paper.

The nanowires have a rigid crystal structure, but the papery network will easily bend. It is also transparent, because tiny gaps between the wires let visible wavelengths of light pass through. Wang adds that more work is needed to create large sheets of nanowires with uniform thickness.

There are other ways to incorporate silicon circuits into bendy materials , says Mark Baxendale of Queen Mary, University of London. "There are plenty of flexible, transparent things around we could put electronics on," he says. But he still expects the nanowire paper to be well received. "People want to see silicon in technology because it is well understood," he says.

(19 September 2013 New Scientist [www.newscientist.com](www.newscientist.com))

**Text 7**

**UNDERWATER ROBOT GLIDERS ARE THE EYES OF THE STORM**
by Hal Hodson

*Ocean-going robots off the east coast of the US promise to predict the magnitude of hurricanes with unprecedented accuracy*

THE next time a hurricane bears down on the east coast of the US, robots will be lying in wait.

The National Oceanic and Atmospheric Administration (NOAA) is to use autonomous underwater vehicles, known as gliders, to monitor ocean temperature as the storm rages overhead. The data it gathers will allow meteorologists to predict the magnitude of a storm with unprecedented accuracy, and improve storm warnings and forecasts for the tens of millions of people who could be in harm's way.

Lou St. Laurent at the Woods Hole Oceanographic Institution in Massachusetts, who uses identical technology in his own work, says the gliders will help fill a hole in hurricane prediction science. Existing forecasting models are good at plotting a storm's path, but they fall down in trying to predict its magnitude at landfall.

Hurricanes are powered by energy pulled out of warm seawater, so sea surface temperature data collected by satellites is fed into forecast models to estimate their intensity. But satellite measurements can't be taken through cloud cover. "Right now, all we have is sea surface temperature from before the weather got bad," St. Laurent says. Relying on models of sea surface temperature rather than direct measurements reduces the accuracy of predictions and means forecasters can't be sure of a hurricane's strength when it hits the coast.

"What's the difference in billions of dollars between the damage caused by a category 4 and a category 5 storm? 50? 100?" St. Laurent says. That kind of information is needed to plan the onshore response, and to make decisions about emergency evacuations. "Gliders are the only way of having an oceanographic presence during a hurricane," he says.

NOAA is in the process of rolling out a fleet of 15 gliders in a swathe of ocean that spans from Nova Scotia to Georgia, after pairs of gliders on unrelated missions inadvertently got caught in superstorm Sandy last year but came through in one piece. Each glider, torpedo-shaped and filled with circuitry, propels itself by adjusting the volume of air in a bladder in its nose – the buoyancy of a larger bladder will force the nose up, while making it smaller tips the glider down. Wings and a rudder direct the force generated by these buoyancy changes, pushing the glider along its path in graceful arcs, known to oceanographers as yo-yos.

While the gliders can be steered through the ocean, they don't move fast enough to guarantee that they will make it into the path of a storm. NOAA will forecast storm tracks to manoeuvre gliders into position beforehand, giving them the best chance to make real-time observations.

Zdenka Willis, who runs the NOAA Integrated Ocean Observing System Program, says it's time to start using them in earnest. "This year we are looking to take gliders into a much more operational mode," she says. "We want to saturate the east coast of the US with these gliders."

They won't be the only sensing gear monitoring storms. Since 2010, NASA has been flying Global Hawk drones over hurricanes and using radar to get detailed looks at the bands of thunderstorms inside. The aircraft can fly for up to 26 hours, allowing researchers to get a real-time view of the evolution of the storm.

St. Laurent says the gliders will revolutionise hurricane science: "Suddenly you have the ability to lay a data grid out under the ocean and collect real information before, during and after a storm event."

(18 September 2013 New Scientist www.newscientist.com)

**Text 8**

**SAMSUNG LAUNCH KICKSTARTS THE SMARTWATCH BOOM**
by Paul Marks

Cellphones liberated many of us from the need to wear a wristwatch – they could tell you the time and let you check your friend's Facebook status. But now the watch is poised to make an unexpected comeback in the shape of "smartwatches", which let you check your messages and social media without having to fish your phone out of your pocket.

Not convinced? Many still aren't, but big tech is banking on smartwatches being the next big thing. The first of the big name smartwatches was unveiled yesterday at the International Radio Exhibition in Berlin, Germany. Called the Galaxy Gear, this $299 Android-powered smartwatch has been developed by Samsung to communicate wirelessly with the firm's phones. While other firms have

launched similar gadgets in the past, it is Samsung's launch that has really fired the gun on the race to corner the coming smartwatch market.

The idea is that smartwatches will liberate us from the hassle caused by the cellphone itself – sparing us the bother of retrieving our smartphones from our pockets to see who has called, tweeted, texted or emailed. Instead a flick of your wrist could tell your smartwatch to get wireless updates of texts from your phone. Other "micro interactions" could also be programmed, such as voice commands to check Facebook messages or call your best friend.

Such watches could also take on the traditional role of a phone. Holding the Galaxy Gear to your ear lets you answer a call, Dick Tracy style, for example. "For everyday moments you don't have to take out your smartphone anymore," Samsung research director Pranav Mistry says.

### Fitness first

But it doesn't end with less fiddly phoning: as they are in contact with your skin, smartwatches offer the perfect wearable platform for "quantified self" fitness apps. Developers could build in dedicated workout tracking devices like the FitBit or Nike FuelBand.

Samsung isn't the only company developing such tech. Apple is readying an iWatch to connect wirelessly with iPhones, while others hatching smartwatches include Google's Motorola Mobility operation, LG of South Korea and Qualcomm of San Diego, California. Then there's the host of crowdfunded start-ups typified by Pebble of Silicon Valley.

Competition comes in the form of Google Glass, which also controls a smartphone via micro interactions: the voice command "OK Glass" gets the system's attention before you tell it to, say, reply to a message or share a picture.

### Early days

Thad Starner, head of Google's Glass project, believes it's early days and that there will be many ways to interact. "Wristwatches are certainly another way to do micro interactions. Simple features like displaying caller ID can be very powerful. I suspect we'll see a suite of devices in the future from which a user can choose what suits them best."

Robert Milner, who works on smart devices at UK-based Cambridge Consultants, agrees. "It is users that will drive the form these devices eventually take. Smartwatches could be a stepping stone to Google Glass, for instance, but in sports, glasses could get in the way. The watch is perhaps a better platform for adding multiple features. It is far from obvious which way this is all going to go."

Whatever happens, it is ease of use that will win out, says Starner. "The difficulty is in creating interfaces that provide the maximum utility for the minimum visual or manual attention on the part of the user," he says. "Creating the right set of features is where the magic is."

(11 September 2013 New Scientist www.newscientist.com)

**Text 9**

## NANOTUBE-COATED SPIDER SILK CAN SENSE YOUR HEARTBEAT

by Chelsea Whyte

Spider silk darkened with a coating of carbon nanotubes can tell if your heart just skipped a beat.

Following a few simple steps, researchers have made a silk-nanotube hybrid that is tough, flexible and electrically conductive. The material might find uses in a range of bendy medical sensors.

Long known as one of nature's toughest and most flexible materials, spider silk is not naturally conductive. Scientists have previously married metals such as gold with spider silk, but those hybrids didn't allow the silk to stretch as much as usual.

To create a conductive but less rigid silk, Eden Steven at Florida State University in Tallahassee collected bundles of silk from a species of golden orb-weaver spider. He polarised a powder of carbon nanotubes so that the tubes would stick to the naturally charged silk, then mixed the materials with a few drops of water and pressed them between two sheets of Teflon.

**Wrap, shrink**

When the material dried out, the silk was coated with a thin layer of nanotubes. This composite is three times tougher than spider silk alone . As the silk naturally expands and contracts when exposed to different humidity levels, the new, flexible hybrid can be easily manipulated to create good electrical contact for wiring. "We simply wind the coated fibre around the contact area and, by controlling the humidity, we can let it shrink. The wire grips the contact area without having to use a conducting paste or solder."

The carbon-silk combination is also sensitive enough to detect the electrical signals from a heart pulse.

Commercially available pulse-detectors are often made of rigid materials. By contrast, the silk-based version can be wrapped around irregularly shaped objects, such as wrists or fingers, without losing sensitivity.

**Kitchen simplicity**

"These results open new opportunities in moulding and shaping actuators or sensors, where you could potentially think about different geometries or forms," says bioengineer Kimberly Hamad-Schifferli of the Massachusetts Institute of Technology. There are other methods of combining carbon nanotubes with biological materials, she adds, but they usually require expensive equipment and chemicals, and the end result is not mouldable.

"What's really astonishing is that the method of incorporation of the carbon nanotubes is incredibly simple," she says. "It looks like something you could do in your kitchen at home."

Scaling up production may be a challenge, though, as it is hard to farm spider silk in large amounts. But there has been recent progress  making synthetic silk, Steven says, which could pave the way for large-scale production.

(10 September 2013 New Scientist www.newscientist.com)

**Text 10**

## CARBON NANOTUBES ON A SPIDER SILK SCAFFOLD

by Eden Steven, Wasan R. Saleh, Victor Lebedev, Steve F. A. Acquah, Vladimir Laukhin, Rufina G. Alamo & James S. Brooks

The immense demand for electronics, and thus the electronic waste and environmental pollution it generates, poses a growing problem that will require innovative solutions1. Many toxic elements and non-biodegradable plastics are commonly found in conventional electronics, and efforts to develop new eco-friendly electronic designs are therefore desirable. Incorporation of natural materials into these designs is advantageous to reduce the quantity of toxic components of the electronic devices. Moreover, natural materials often possess complex and robust physical properties that can be harnessed for electrical and sensor applications. Spider silk (SS) is one such material and the combination of its toughness and bio-compatibility makes the material strategically important for implant, electrical, sensor and actuating applications.

SS, a protein-based natural polymer, is a flexible but strong material due to its helical-elastic and β-sheet crystalline composition. An unrestrained neat SS fibre expands in both length and diameter when humidified up to ~70 or 80% relative humidity (RH). At higher RH, the fibre experiences supercontraction, where it shrinks in length, expands in diameter and becomes soft. This fibre shrinkage is typically an irreversible process. The fibre softening, however, is a reversible process. In addition, the fibre also experiences cyclic contraction, a phenomenon different from supercontraction, where the fibre extends when exposed to a high-humidity environment. These factors are key to the work presented here.

For technological applications, where constant strength and flexibility in a variable environment are desired, supercontraction may be regarded as a problem. However, both supercontraction and cyclic contraction can be exploited for actuating applications. For example, it has been shown that SS fibres can be used as a biomimetic muscle with an exceptional work density, 50 times higher than other biological muscle fibres, estimated to be capable of lifting a 5 kg mass with a 1mm thick SS fibre. SS fibres can also be used as contactor shadow masks during thin film deposition, generating micro-or nano patterned features without lithographic processing. Moreover, starting from its intrinsic properties, SS fibres can serve as a versatile scaffold upon which additional functions can be built. For example, CdTe, magnetite and gold nanoparticles can be used to functionalise SS for fluorescent, magnetic and electronic applications, respectively. Gold-functionalised fibres (Au-SS) have been shown to be electrically robust down to cryogenic temperatures. Even though Au-SS possesses sufficient flexibility for use as electrodes in microelectronics, generally its elasticity and electrical continuity are not adequate for electronic sensors or actuating devices.

Here we show that supercontraction, and in particular, silk fibre softening, provides a simple and effective route of SS functionalisation with carbon nanotubes (CNTs), enabling use in electronic applications including sensors and actuating

devices. We report a strong affinity for amine-functionalised multiwall CNTs (f-CNTs) to adhere to natural Nephila clavipes SS fibres. Adhesion is facilitated by water and mechanical shear, and enhanced by polar interactions and bonding between the SS and f-CNT side groups. The process results in SS fibres uniformly coated with f-CNTs (f-CNT-SS) providing an electrically conducting path, and thereby a self-monitoring mechanism for physical changes and/or stimuli to the f-CNT-SS structure. The f-CNT-SS fibres are ~300% tougher than neat silk fibre, versatile and multi-functional, and exhibit polar shapeable, conducting, flexible, strain- and humidity-sensitive properties. Proof-of-concept f-CNT-SS-based heart pulse sensor and current-driven actuator devices are demonstrated.

### Results

### WATER-BASED F-CNT COATING OF SS FIBRES

We discovered that by mixing a bundle of dragline SS fibres (~2□cm long) with a dry powder of f-CNTs (Methods section), applying a few drops of water, and then pressing and shearing the mixture between two Teflon (Polytetrafluoroethylene) sheets, the fibres turned very black, and when dried, contracted to a well-defined geometry where the silk fibres were uniformly coated with nanotubes. The neat bundle contained multiple dragline silk fibres in their natural double-stranded arrangement (each strand has a diameter of ~4 μm), all of which were coated simultaneously. After the coating process, the dragline silk fibres were well separated into individually coated single-strand fibres (referred to as single fibres for the rest of the paper), accompanied by small isolated f-CNT aggregates.

This separation allowed reliable extraction of single silk fibres from the bundle. SEM and TEM images of the single silk fibre show that the f-CNTs are attached to the SS structure, including some penetration of the nanotubes into the SS surface. This procedure produces a basic uniform annular f-CNT coating with thickness of ~80-100 nm with occasional f-CNT aggregates of ~1 μm in diameter and thickness. Additional SEM and TEM images of another silk fibre are available.

We have also performed a control experiment involving pre-supercontracted fibres. The neat fibres are first immersed in a water bath for 30 min, followed by air drying, and then the water-based f-CNT coating is performed. The water-based procedure is also effective on these pre-supercontracted fibres, indicating that the initial shrinkage of silk fibre is not the most important factor to achieve the effective coating, but it is the softening of the fibre during supercontraction.

We note that a dry powder of pure multiwall CNTs (MWCNTs) does not provide effective initial dispersion and adhesion to the SS fibre (Supplementary Fig. S3). As a result, it is not possible to coat the SS fibre with pure MWCNTs using our water-based method. Likewise, only SS fibres exhibit an effective f-CNT coating compared with nylon, polyester, cotton and some acrylic fibres where either spotty or no coating was observed. Unlike water, other solvents such as hexane, toluene, methanol, ethanol, acetone, dichloromethane and dimethylsulphoxide do not facilitate a uniform coating.

**Text 11**

**NEW UK NUCLEAR REACTORS GET GO-AHEAD AFTER PRICE DEAL**

by Michael Marshall

The UK is to build its first new nuclear reactors for 25 years. The government has signed a deal with EDF Energy setting out the terms under which EDF will build and run the reactors – in particular, how much the company will be paid.

The two reactors will be built at Hinkley Point on the Somerset coast. Once they are up and running, which is expected to be in 2023, the reactors will supply about 7 per cent of the UK's electricity.

EDF and its partners, which include two Chinese companies, will fund the construction of the reactors, without direct financial help from the government. "For the first time, a nuclear power station in this country will be built without money from the British taxpayer," says Edward Davey, the energy and climate change secretary.

However, in return EDF has arranged a guaranteed price for the electricity generated. This "strike price" of £89.50 per megawatt hour is almost double the average cost of electricity in the UK in 2012, which was about £45.50 per megawatt hour.

**Bitter bill to swallow**

On the face of it, that looks like bad news for UK consumers, who are facing rises in the cost of energy of about 9 per cent this winter. But the bills from Hinkley Point are 10 years away, and the UK's Committee on Climate Change says that current rising prices are driven largely by rising gas costs.

"The price is higher than I would have hoped for," says Jim Watson of the UK Energy Research Centre in London. "I'm not sure that consumers have got the best deal. But to be fair, the government has been negotiating with a single bidder."

A second consortium, Horizon Nuclear Power, had previously expressed interest in building new nuclear reactors but suffered a setback in 2012 when its main investors pulled out. This lack of competition put EDF in a strong negotiating position.

"Amid understandable public concern about rising bills, it's important to remember this investment will help mitigate the impact of increasing costs," says John Cridland, the director-general of the Confederation of British Industry. "Whatever we do, energy prices are going to have to go up to replace ageing infrastructure and meet climate change targets – unless we build new nuclear as part of a diverse energy mix."

EDF is considering building a second pair of nuclear reactors at Sizewell in Suffolk. The agreed strike price assumes that this will go ahead. If EDF does not follow through, the strike price will go up to £92.50 per megawatt hour. That's because building multiple reactors creates economies of scale, allowing EDF to accept a lower price.

"One plant is expensive and the worst way to do your nuclear economics," says Watson. It's best to build multiple reactors, as China is currently doing, as this will ensure the resulting electricity is as cheap as possible.

Since Hinkley won't come online until 2023, later than previously expected, Watson says it will be crucial to add extra renewables to the grid in the meantime, and improve energy efficiency. "Doing other things at the same time is really important."

(21 October 2013 www.newscientist.com)

**Text 12**

## BODY-WORN CAMERAS PUT POLICE EVIDENCE BEYOND DOUBT

by Paul Marks

*It's hard to argue with video evidence from a camera that records everything a police officer sees – and it keeps the cops in line too.*

WHEN a young man threatened to kill a police officer's children and bite off his nose in A&E at a hospital in Hampshire, UK, earlier this year, there was a chance his behaviour would go unpunished. After all, it was just his word against the officer's – except that the policeman was wearing a video camera that captured every word. The man was successfully prosecuted for threatening behaviour.

Welcome to the new era of policing and surveillance. The rise of body-worn video (BWV) is making life easier for police officers – but it could make sure they toe the line too. The camera used as evidence in this case was one of 450 that Hampshire police is now rolling out to its officers.

Footage from another BWV camera was also crucial when villagers reported a serial drink-driver in their midst, says Stephen Goodier, an inspector with Hampshire Constabulary. In court, the suspect claimed he had never been asked to take a breathalyser test, and so could not have refused to take one, as an officer alleged. But BWV footage clearly showed him refusing to take the test. "He was banned from driving," Goodier says. "When it is one person's word against that of another before a judge and jury, the body-worn camera is an independent witness."

On 13 October, Staffordshire Police decided to equip 530 officers with BWV cameras from UK firm Reveal Media after they'd been rolled out in Sweden, Germany, Denmark and France. And in the US, police departments coast-to-coast are acquiring BWV cameras from stun-gun maker Taser International, plus CopTrax of Plano, Texas, as well as Panasonic.

CopTrax just tweaked its BWV camera software to work with Google Glass so it records what the officer actually sees, rather than a view from a chest, lapel or collar cam. On 13 September police in Byron, Georgia, made the first arrest on record – a parole violator pulled over for speeding – using CopTrax's Google Glass system, which streamed officer-viewpoint video of the arrest live back to police HQ. "A chest-mounted camera does not always give as good a perspective on a scene. It can be facing the wrong way when the officer is talking to someone," says CopTrax video manager Bill Switzer.

However it is done, these on-officer cameras are generating first-person videos of interactions with the public that are already having a profound effect on policing. Confronted with footage of their actions, defendants are pleading guilty earlier, says Alasdair Field, CEO of Reveal Media. And complaints from the public about police brutality or misuse of their power can be settled faster and with less bureaucracy.

People in a brawl often calm down suddenly when told they are being videoed, says Gavin McMillan, also a chief inspector in Hampshire. Indeed, a police department in Rialto, California, reported in April that the use of force against its officers declined 59 per cent when they began wearing cameras. "Our cameras have a front-facing screen to maximise this effect," says Field.

Fuelling the move towards such wearable surveillance are the tiny cameras and high-power batteries developed for smartphones. BWV cameras have existed in the past but they have been impractical because they always needed large extra batteries. Recent uptake has a generational element, too: "The younger generation of police officers grew up in the internet video age and are comfortable recording digital video for sites like YouTube, Vine and Facebook," says Steve Tuttle, vice-president of Taser International.

Officers may be happy but what about the average civilian? How might they gain or lose from this? Surprisingly, perhaps, the American Civil Liberties Union has given qualified backing to BWV because of its "potential to serve as a check against the abuse of police power". But ACLU has two major provisos: first, recording must be "always on" so that officers record complete interactions with a suspect – and do not edit "on the fly" by recording only what backs their version of events. Second, ACLU says the back-office data storage system for video evidence must be secure, accessible to lawyers and defendants – and yet also automatically delete recordings of no interest after 30 days.

"In reality 'always on' recording would become totally unmanageable and the technology could not do it," says Goodier. So his officers click the video on when they approach a suspect and switch it off afterwards. Reveal Media's software flags up officers who are switching recordings on and off too often, allowing checks to be made on them. And the CopTrax system starts recording automatically when a squad car's siren and blue lights are turned on, says Switzer.

ACLU wants research to keep tabs on how BWV can be used and abused and, in fact, the criminal justice department at the University of Portsmouth, UK, has just started such a study.

Goodier agrees that secure, shareable video data storage is key. "We need to be able to share footage easily with anyone in the justice system that needs it," he says. "We need a policing version of YouTube."

**Chase them down with Google Glass**

THE body-worn video camera from CopTrax of Plano, Texas, is an extension of its squad car dashcam system that takes in video wirelessly from a smartphone mounted on an officer's body armour (see main story). But smartphone specifications change too often for the software to keep up, says CopTrax's Bill Switzer – so they have turned to Google's wearable computer, Glass.

They have tested Glass in conjunction with police handguns and assault rifles and the headset does not obscure aim. The live GPS feed from Glass will help commanders work out where officers are when pursuing suspects – as well as show events as they unfold from the police officer's perspective.

(23 October 2013 www.newscientist.com)

**Text 13**

## DOLPHIN SONAR INSPIRES COIN-SIZED BOMB DETECTOR

by Paul Marks

FLIPPER would be impressed. Dolphin clicks have inspired the development of a cheap, coin-sized radar gadget that can sense hidden electronics. The device could be used to find covert surveillance bugs, bomb triggers or timers – even if they are hidden in large piles of clutter or garbage.

While watching a nature show, acoustics engineer Timothy Leighton of the University of Southampton, UK, wondered why dolphins blow clouds of bubbles from their blowholes to corral fish. Surely, he thought, these "bubble nets" must reflect sonar clicks and wreck the dolphin's ability to locate their prey? "Even the best man-made sonar couldn't distinguish between the fish and bubbles," he says. "There had to be something else going on."

By experimenting with different forms of acoustic signals, he found that a large pulse followed by a small one could reflect sound waves in such a way as to allow fish and bubbles to be easily distinguished. "We built a sonar that did this and took it out to sea and it worked beautifully," Leighton says, though he adds that he isn't sure this is how dolphins detect their prey.

The same technique should also work with radio waves, so Leighton built a prototype radar and tested it. He found it could tell the difference between a wide range of materials (Proceedings of the Royal Society A, DOI: 10.1098/rspa.2013.0512).

The radar is small – about 2 centimetres across – and Leighton says it can be built for just €2. "If you have bombs hidden in roadside rubbish like plastic bags, wood scrap, bike wheels and drinks cans it distinguishes the interesting devices – those containing metal wires and semiconductors – so you might pinpoint a bomb circuit for instance," he says.

It could also be used after an earthquake to locate people buried in rubble by seeking their iPods or phones.

"This advanced radar shows promise," says Gary Kemp, programme director at Cambridge Consultants in the UK. Any technology that increases the probability of detecting improvised explosive devices or buried casualties will undoubtedly save lives, he says. "Evolution has once again sparked ideas for remarkable innovation."

(23 October 2013 www.newscientist.com)

**Text 14**

## SMUGGLER-SPOTTING SOFTWARE SNIFFS OUT DODGY SHIPMENTS

by Hal Hodson

IS THAT boatload of toys what it says it is? Spotting illicit cargo among the billions of tonnes of goods that move through the world's ports each year is about to get easier, thanks to machine intelligence.

Smuggling hit the news in July, when a North Korean ship, the Chong Chon Gang, was stopped in Panama as it transported arms from Cuba. The weapons were hidden underneath 200,000 bags of sugar. The sugar and "2000 empty polyethylene bags" were the only items listed in the cargo manifest, which should have aroused suspicion.

But existing tools for finding anomalous records are primitive and involve only very basic checks, says Antonio Sanfilippo at Pacific Northwest National Laboratory in Washington state. So he has created a data-mining system that can scan millions of ship manifests to find cargoes that don't seem quite right.

To do this, his team created an algorithm to analyse 2.4 million shipping records from industrial data broker PIERS. Each manifest includes 19 fields, such as the ship's name, cargo description and port of origin. The algorithm uses this information to assign the record to one of 25 clusters. It then finds the outlying records in each cluster – those that don't fit in with the existing patterns for those routes, say, or are carrying an unusual cargo for that ship. There could be perhaps 15 suspicious records out of tens of thousands, which would then be investigated.

Spotting dodgy cargo as it comes through customs is becoming harder than ever, says Hugh Griffiths, who works on countering trafficking at the Stockholm International Peace Research Institute in Sweden. "The role of controlling goods, and the ability to conduct investigations has been curtailed. Industry has a huge amount of data, but customs is working with very little." He suggested to the US House Committee on Foreign Affairs in Washington DC last month that a vessel's previous routes and ownership patterns could hint at whether it was carrying illicit goods.

Sanfilippo will present his system at the IEEE Conference on Technologies for Homeland Security in Waltham, Massachusetts, in November. It has already found that shipments of toys have the most anomalies – just a year after two men were arrested on suspicion of sending gas centrifuges to Iran, under cover of a toy shipment. The next step is to use the data to create a network of all the shipping organisations and their connections, so the system can spot suspicious links.

The job of stopping smugglers is getting increasingly complex, says Griffiths. "It's become much harder to detect narcotics shipments, counterfeit goods and arms. It's a very complex issue, and no one has been able to solve it."

(23 October 2013 www.newscientist.com)

**Text 15**

## HAS THE TIME COME TO ABANDON ONLINE ANONYMITY?

Sometimes it seems as though the only people who benefit from online anonymity are trolls. Has the time come to ditch it?

ANONYMOUS trolls. The phrase has become commonplace in accounts of online abuse. It can seem as if anonymity protects only scoundrels. Has the time come to abandon it?

The very idea will be anathema to some. Anonymity promises invaluable freedom from social, professional and political constraints. Without it, how readily would critics and whistle-blowers speak up? Would the Arab Spring have happened? If you believe in free speech, there are clear reasons to defend it.

Nonetheless, many of us have already given up our anonymity as our physical and digital lives have become entangled. That suits internet companies, who want real people as their customers, not shadowy aliases and sock puppets. They also hope we will behave better if we are readily identifiable.

That seems a forlorn hope. True online anonymity is hard to achieve, but technically savvy internet users can get close to it – and some will continue to hide behind it as they savage others. And there will always be some people who will simply shrug if they are unmasked.

Perhaps we are focusing on the wrong target. In every society there are a few sociopaths. What makes the internet variety particularly hard to deal with is their knack for duping others into joining their campaigns.

Many of these supporters are just jumping on a bandwagon, or have been misled about the  nature of a purported dispute. Exactly why we are so quick to rush to judgement online, and to dehumanise the subject of our ire, is worth looking into further. But regardless of the reasons, the resulting mob  greatly amplifies the effect on the target.

As to limiting such behaviour, a more effective approach may be to induce a sense that our actions are being watched.  This seems to encourage people to behave in line with prevailing social norms, and turns out to be surprisingly easy to achieve (see "The end of anonymity: A way to stop online abuse?").

This is not without its Orwellian aspects. But social norms do not have to be imposed: they can be created by mutual agreement. Appealing for  greater civility may seem naive, and certainly can't by itself solve online abuse – but it's a start. Perhaps we could all do with thinking twice before we click.

(25 October 2013 www.newscientist.com)

**Text 16**

## GET ROUND INTERNET CENSORS USING A FRIEND'S CONNECTION

by Hal Hodson

*People living under repressive regimes will soon be able to access the web using the internet connection of friends in censorship-free countries.*

FOR people living under repressive regimes censorship is an everyday reality, and browsing the internet freely is impossible without some serious technical know-how. This week Google threw its weight behind an idea that lets people circumvent censorship by using the internet connection of a friend in a non-censored country.

A collaboration between the University of Washington in Seattle and non-profit firm Brave New Software, uProxy lets users share their internet connection with friends on social networks through a browser extension.

When both parties have the uProxy extension installed, one can forge an encrypted link through the other person's browser and out onto the internet via their social network connection. As well as giving people access to censored content, it could allow people in the UK to watch the US version of Netflix via a US friend's connection, for example, or those in the US to log in to the BBC iPlayer to catch the latest episode of Sherlock.

So far it has only been tested in a closed trial for selected users, but its developers promise to open up the code to curious security researchers. This will also ease fears that any back door may have been left open for authorities such as the US National Security Agency to access and spy on users' browsing habits. Censors can't stop uProxy simply by blocking social networking websites either because, instead of the standard web, it accesses the contact lists via background, hard-to-block online processes.

UProxy was funded by Google's charitable arm, Google Ideas, and the firm is also helping in its development. And it isn't the only anti-censorship tool that uses our friends to get online. Lantern – another Brave New Software project – also relies on your social network to find a trusted computer to connect to the wider internet. Unlike uProxy, it can use friends of friends, widening the pool of potential proxies. Like anonymising software Tor, it is funded by the US Department of State.

Adam Fisk, CEO of Brave New Software, says there are advantages to using a person's social network in this way. For one, censors will have trouble finding and blocking the IP addresses of all your peers. With Lantern and uProxy, the more people that use the service, the harder it is to censor, as more and more trusted proxies become available.

"We're capitalising on the emergence of social networks," says Raymond Chang, a graduate student at the University of Washington who is working on uProxy.

Many anonymising tools still require a high degree of computer literacy to use, although there are some apps that allow people to make encrypted calls and send

emails. Google makes its money through easy-to-use web applications, so it's reasonable to expect that uProxy will exhibit some of the same characteristics.

Lantern may also be easy to use, as the plan is to build Gmail encryption right into the system, with all the complicated key exchanges hidden from the user.

Dan Staples of the Open Technology Institute in Washington DC says letting users place trust in people they know for access to the internet is unique. "No matter what, I have to place my trust in someone when I use digital technology," says Staples. "I think the uProxy and Lantern projects are taking a positive approach."

(30 October 2013 www.newscientist.com)

**Text 17**

## BUTTONMASHER: FIRST AR GAMES FOR GOOGLE GLASS EMERGE

by Simon Parkin

ButtonMasher is our new column about video games and gaming culture – from the offbeat fringes to the cutting-edge innovations behind the latest blockbusters How can you bring history to life? Forget the frayed communal headphones and audio guides at museums. With Google Glass, the wearable computer that is due for release next year, we will one day be able to go somewhere and read about local history while we stare at its real-life contours. But for some video-game developers, merely annotating the world isn't enough. They hope to give us the power to change history with our eyes.

"Imagine visiting the site of the battle of Waterloo," says Guillaume Campion, head of production at AMA, a French studio that is one of the first to be developing video games for Glass. "You begin by reading about what happened during the battle through the glasses. But then you have the opportunity to play a game set within that context. Maybe you can even try to change the outcome of the battle in some way."

Video games, once confined to computers and dedicated consoles, have broken into the wild in recent years. As the size of smartphones has shrunk and their power increased, so developers have sought to take video games to new contexts. Google Glass offers the next logical platform in this trend. Since February this year, when the first developers were given the hardware, a number of game projects have emerged including Swarm, an augmented reality game that casts players as ants that must complete tasks, and GlassBattle, a Google Glass-based take on Battleships.

**Sixth sense**

AMA, which revealed a simple puzzle game titled Escape as a proof-of-concept title at the Game Developer's Conference in Germany in August, is one of the major studios leading the Google Glass charge. Escape may be a far cry from Campion's colourful vision of an interactive battle of Waterloo: in the game you guide a stick character around a path of dots. But the studio has been investigating ways to create games that are mapped to the real world in some way.

"Google Glass is like a sixth sense: when you wear it you're always connected, so you can keep an eye on the real environment while using applications without your hands," says Campion.

Despite the potential, there are significant challenges to playing games on the device, according to Det Ansinn, founder of BrickSimple, the company behind GlassBattle. "User input is a huge challenge," he says. "The only direct physical input is a touchpad on the side of the device. Beyond that, you have an accelerometer, gyroscope and compass. There's a pupil detector that offers very limited utility.

"When you design a game for Glass, you're limited to voice, an awkward touchpad, and those sensors. I'm certain that developers will find interesting ways to use those inputs, but it's not conducive to traditional gaming input."

**Rethinking gameplay**

As such, developers can't directly port a smartphone game to Google Glass; they have to rethink the entire user experience. "This device is not meant to be the next console, but does present a new way of playing." Ansinn says. "Now the challenge is to create new genres, new types of gameplay."

AMA isn't the only team to have envisioned a world in which video games can be seamlessly layered on top of what we see around us. One YouTube user recently uploaded a mock-up of how Google Glass could be used to deliver a Call of Duty-style first-person shooter, a true multiplayer game, set in a disused quarry.

It's a compelling vision of the future. But Campion remains unconvinced that this is the best direction for Google Glass games. "I don't think this kind of experience will offer the killer game app for Glass," he says. Ansinn agrees, saying the current Google Glass hardware is a limiting factor.

"Glass is not a full augmented reality experience," Ansinn says. "The display occupies a small upper corner portion outside of your normal field of view. While Glass has ignited the imagination for full augmented reality experiences, when you wear the device, you quickly realise that it can't deliver on some of those imagined experiences."

Ansinn believes that future versions of Glass will soon augment the wearer's entire field of view. "I have no doubt that is coming – this first iteration is a baby step to that dream," he says. "But for hardcore gamers, it has a long way to go. There's much to be said for traditional controller input."

Even so, he remains optimistic that Glass could provide a serious platform for both developers and players in the future. "Combine display advancements with the leaps being made in mobile CPUs and GPUs, and full world-enveloping gaming experience will be here within five years. These are early days."

(1 November 2013 www.newscientist.com)

**Text 18**

## GEOENGINEERS ARE FREE TO LEGALLY HACK THE CLIMATE

by Michael Marshall

THE idea of artificially cooling the climate may have come in from the cold, but the laws governing trials of the technology are still all at sea. Many people think such trials are illegal, but this is not the case, according to an analysis of environmental treaties.

The latest report from the UN Intergovernmental Panel on Climate Change includes geoengineering – a sure sign that the idea has become respectable. But research and field trials are needed before we know whether influencing the climate like this is a viable option for cooling Earth.

This is easier said than done. In 2010, the UN Convention on Biological Diversity (CBD) forbade any form of geoengineering that could affect biodiversity – which is effectively all of them. And any geoengineering that involves adding chemicals to the ocean, to increase the carbon sequestered, for example, is prohibited by the London Convention and Protocol (LCP). However, some small-scale trials have gone ahead.

To find out the legal status of such trials, Jesse Reynolds of Tilburg Law School in the Netherlands went through the fine print of 15 major environmental treaties, including the CBD, the LCP and the United Nations Framework Convention on Climate Change. He found that apart from the LCP's ruling on dumping material into the sea, which is legally binding, the language of the other treaties actually permits field tests. The CBD statement, for example, merely "invites" governments to ensure no geoengineering activities take place, rather than making it a legal requirement to do so (Washington and Lee Journal of Energy, Climate, and the Environment, ssrn.com/=2326913).

Reynolds found that most of the treaties encouraged countries to perform research, clean up pollution and minimise risks. Because geoengineering research is meant to reduce the risk from climate change, Reynolds says "international environmental law generally favours such field tests".

"The fallback position is that countries are more or less free to do what they want," says Scott Barrett of the Earth Institute at Columbia University in New York. The ambiguous legal situation needs clearing up, says Barrett. For example, countries could agree basic rules. Those planning large trials ought to say so, he says: "There should be a presumption of the whole world going together."

Many treaties could incorporate rules on geoengineering, but Barrett says the obvious choice is the United Nations Framework Convention on Climate Change, which holds its next meeting in November in Warsaw, Poland. "If this is to be discussed anywhere, it should be there," he says.

(31 October 2013 www.newscientist.com)

**Text 19**

## SEND A TEXT MESSAGE TO CHARGE YOUR CELLPHONE

by Anil Ananthaswamy

*People living off-grid can now pay for electricity to power their phones simply by sending a text message□– the cheapest method found so far.*

AT THE Konokoyi coffee cooperative on the edge of Uganda's Mount Elgon national park, Juliet Nandutu is trying out a new toy: a solar-powered cellphone charging station that is activated by text message. She is offering the service to her village. "I charge 18 phones a day, sometimes 20," she says.

How many phones she charges depends on the local electricity supply. When it's there, people can charge their phones at home, but that's not very often. "It's not so reliable," she says. "It's on and off."

A patchy or absent power grid poses a conundrum for rural areas in the developing world, particularly in Africa and Asia, where the use of cellphones is rapidly rising. Farmers, for instance, use cellphones to get up-to-date pricing information for nearby and distant markets, allowing them to better manage the sales of their crops. In Kenya, people without access to banking services exchange money using their phones. Still, an estimated 500 to 650 million cellphone users are off-grid. Now London-based company Buffalo Grid and its portable charging station is hoping to step into the gap.

The lack of access to grid power means that people have to trek for kilometres to a nearby town to find a charging station, powered by diesel generators or solar panels. More importantly, it's  not cheap. In Uganda, charging a cellphone can cost 500 Ugandan shillings, or about $0.20. That's a huge burden for those who earn less than a dollar a day, especially when you have to charge the phone two or three times a week. Rural areas need stronger signals from cellphones because there are fewer cellphone towers nearby, a further drain on power. "In rural economies, about 50 per cent of the money spent on mobile phones is actually spent on charging them," says Buffalo Grid's Damon Millar. "That is some of the most expensive electricity in the world."

Buffalo Grid's basic technology, which was recently trialled in Uganda, should help cut those costs. A 60-watt solar panel charges a battery that is taken to  the village on the back of a bicycle. The battery extracts power from the solar panel using a technique called maximum power point tracking (MPPT). A solar panel's power output  is dictated by environmental conditions, such as temperature and the amount of sunlight, as well as the resistance of the circuits connected to  it. MPPT monitors the conditions and changes the resistance to ensure the maximum possible power output at any given time.

The innovation lies in how the stored power is released to charge a phone. A customer sends a text message, which in Uganda costs 110 shillings, to the device. Once it receives the message, an LED above a socket on the battery lights up, indicating that it is ready to charge a phone.

At the Konokoyi coffee cooperative, each text message allows a phone to be charged for 1.5 hours. A fully charged Buffalo Grid unit can last for three days, has up to 10 charging points and charges 30 to 50 phones a day.

To bring the cost down further, Buffalo Grid hopes to co-opt the cellphone network operators into subsidising power for charging the phones, or even making it free. What's in it for the network operators? "When you bring power to phones that don't have any, people will use them more," says Buffalo Grid's Daniel Becerra. "Instead of paying for the charge, people will spend more on airtime."

It has taken Nandutu a while to make villagers comfortable with the process. "It's a cashless business," she says. Sometimes, phones can take more than 1.5 hours to charge, which means sending another text message. "You need to explain to the people what it means," she says. "It's not just about one SMS. It depends on the time the phone takes to charge." Two text messages are still cheaper than the usual cost to charge a phone.

Buffalo Grid also plans to do trials in Sierra Leone, where coffee traders are gearing up to pay farmers for their crop using cellphones. "It'll be a tragedy if a family cannot receive their wages just because they don't have enough battery power," says Becerra. "So, the coffee traders have asked us to implement our unit across these communities, to make sure that every single phone is working all the time."

(9 March 2013 www.newscientist.com)

**Text 20**

**LEAP MOTION HACKS SHOW WHAT 3D GESTURE SENSING CAN DO**

by Hal Hodson

*Gamers, designers and photographers have innovative treats in store when the Leap Motion 3D gesture-sensing computer interface is launched next month.*

THE launch could be a watershed. Since last May, Leap Motion has shipped 12,000 of its 3D gestural interfaces to eager developers around the world. Now, a little over a month before the device's commercial release, we're getting the first glimpses of its enormous potential.

The Leap Motion sensor, which is 100 times more accurate than Microsoft's Kinect and less than half the price, will have a big launch-day head start on its predecessor. Where Microsoft closed off its device and threatened to prosecute anyone who reverse-engineered the $150 Kinect , Leap Motion has provided all that information up front to developers.

This means there will be a host of applications available – from Leap-compatible versions of smartphone games to weather and creativity apps – right from the off on 13 May.

Although it is initially aimed at desktop computers, researchers are already finding ways to jury-rig the Leap to smaller devices, to open up a new realm of interaction. "The idea we envision in the near future is that a Leap Motion-like device

will be integrated into a smartphone," says Mingming Fan of the University of California, Irvine. "Instead of just interacting on the touchscreen, the space around the smartphone will be available too."

Fan has already hacked Leap and a smartphone together into a basic demo, but says that his goal is to use the hand tracking to allow a user to reach into the screen by going behind the phone. With Leap tracking the user's hand and displaying its image on the screen, the virtual hand could then be augmented with a gun, say, for first-person shooter games, or with Photoshop tools.

Another group of developers, LabViewHacker in Austin, Texas, needed just 24 hours with the Leap development kit to be able to rig it up to control a quadcopter using hand gestures.

Larger tech firms have also recognised Leap's potential. Brian Pene, a researcher at 3D design company Autodesk in San Francisco, has built a prototype using Leap which lets users manipulate a digital model of an engine with their own hands. "Let's say you wanted to disassemble and reassemble a 3D engine model," he says. "Using a mouse you'd have to pick up everything in 2D space while constantly manipulating the view. With Leap you can reach in and grab much like you do in the physical world."

Meanwhile, developer Mario Viviani, of Italian firm Mariux Apps, has hacked Leap Motion into a basic photo management system, taking advantage of the extra dimension it provides in and out of the screen to make it easier to handle large volumes of photos. He plans to have the software, currently called Project Agatha, ready for Leap's commercial launch.

Vedran Škarica of Croatian firm divIT points out that it will take some time for the truly game-changing 3D interfaces to appear, as 2D controls are so ingrained with computer users – developers included. "You have to force yourself to forget what you knew, and it takes time to cancel those paradigms. Most Leap demos are just adjustments of multitouch demos," he says.

He also suggests that the enhanced interaction possibilities that Leap offers will trigger a new generation of much more useful 3D displays. "This is the first time that input technology has jumped ahead of display technology," Škarica says. "I've been waiting a while for something that can surpass the mouse , and Leap is definitely it."

(8 April 2013 www.newscientist.com)

# PHYSICS & MATHEMATICS

**Text 1**

## SUPER-ACCURATE ATOMIC CLOCK DOUBLES UP AS QUANTUM SIM

by Lisa Grossman

The most accurate timekeepers in the world just got a new use. It turns out they can double up as simulators to help us better understand the deepest mysteries of the quantum world.

Many problems in physics are difficult to untangle because their underlying behaviour, governed by the intricate rules of quantum mechanics, is too complex for computers to simulate.

One example is the mysterious phenomenon of high-temperature superconductivity, in which electrons move around with no resistance inside a material. This is probably thanks to the collective quantum behaviour of hundreds of particles, too many to simulate computationally. Another example is magnetism, the result of quantum interactions between electrons .

Electrons' behaviour inside solids can be physically modelled  using networks of atoms cooled to trillionths of a degree above absolute zero. These are bigger and easier to control than electrons themselves, so are ideal for experiments  that yield new insights. "Recently there is a big push for using ultracool atoms to mimic solid-state materials," says Ana Maria Rey of JILA, a lab jointly run by the US National Institute of Standards and Technology and the University of Colorado in Boulder.

**Clocks to the rescue**

However, there is a major hurdle to overcome: the fact that ultra-low temperatures are hard to produce in the lab. "This has been a very important limitation," says Rey. Now, she and her colleagues have stumbled upon a way to mimic quantum behaviour in a system several orders of magnitude warmer:  an atomic clock.

Atomic clocks are the most accurate clocks we have and their behaviour is used in the modern definition of the second. They keep time by tracking the hyper-regular movements of a group of atoms between two energy levels.

Rey's team worked with an atomic clock based on an ensemble of strontium atoms trapped by a series of lasers. When a laser pumps in energy, the atoms oscillate between their ground state and an excited state with incredible  regularity, acting as the "tick" of the clock.

To improve the strength of the clock's signal, Rey's team tried upping the number of atoms. Unfortunately, this reduced the clock's accuracy because the atoms' mutual interactions sometimes changed the clocklike regularity of the energy transitions. However, it also suggested a new use for the clock. "The fact that the frequency is changing with the number of atoms is very bad," Rey says. "But it's also a tool."

**Secrets of spin**

Mathematically speaking, the atoms were behaving a lot like electrons in magnetic materials. Electrons all have a property called spin, which can be visualised as an arrow pointing up or down. In a magnet, all the spins point in the same direction, thanks to quantum interactions between them that are still poorly understood.

Rey says that the strontium atoms in the ground state can be used to simulate spin-down electrons, and the excited atoms, spin-up electrons. Tracking the emergence and details of the interactions between the atoms could then shed light on the nature of the quantum interactions between electrons in magnets.

Crucially, unlike the network of atoms normally used to simulate electron behaviour, atomic clocks work at the relatively balmy temperatures of millionths of a degree above absolute zero.

"These are fascinating results," says Mikhail Lukin of Harvard University, who was not involved in the new study. "This work can result in fundamental new insights into quantum dynamics of spin systems."

It's also good for the atomic clock, he adds: knowing how the atoms interact should help us build ever more accurate timekeepers.

(8 August 2013 New Scientist [www.newscientist.com](www.newscientist.com))

**Text 2**

## DARK ENERGY COULD BE THE OFFSPRING OF THE HIGGS BOSON

by Lisa Grossman

The particle credited with giving others mass, the Higgs boson, may also be to blame for the universe flying apart ever faster. That's because the Higgs boson could, in principle, be giving rise to dark energy.

The standard model of particle physics encompasses the fundamental particles that make up matter, as well as associated fields. The photon, for instance, is tied to the electromagnetic field. Discovered last year, the Higgs boson also comes with an associated field but, unlike others of its class, the Higgs field is scalar – it does not act in a specific direction.

Taken together, the known particle fields create a certain density of energy permeating the universe. Before the discovery of dark energy, particle physicists were worried that the simplest versions of the standard model predicted an enormous, possibly infinite energy density that would force the universe to expand at an ever-increasing rate.

That seemed improbable until observations of distant supernovae showed that galaxies are not only moving away from each other, but accelerating. The discovery seemed to resolve the issue, but it turns out that the culprit, which we now call dark energy, is much weaker than the standard model indicates.

"It's very different from what we would predict," says Frank Wilczek of the Massachusetts Institute of Technology. "This is the profound embarrassment of this fundamental feature of the universe."

**Higgs portal**

Spurred by the appearance of the long-anticipated Higgs boson, physicists Lawrence Krauss of Arizona State University in Tempe and James Dent of the University of Louisiana at Lafayette may be on the trail of why dark energy is so wimpy.

"What we show is, if the Higgs exists – which it appears to – it can be a portal to new physics and in principle be associated with a new field, which could give an energy density in the universe that's of the right order of magnitude," says Krauss.

Even before the Higgs was discovered, Krauss was wondering if other scalar fields could couple to the Higgs field, offering links to new physical phenomena. But he was actually a Higgs sceptic until the very end.

"I was preparing papers on why the Higgs doesn't exist, expecting them not to see it at the LHC. Then when they did, it hit me that, my God, all of these possibilities that I'd long discounted involving the existence of new scalar fields in the universe might actually be right."

Krauss and Dent had devised a new scalar field that would exist outside the standard model. Without the Higgs, this field would have zero energy density. But the standard model says that all the fundamental forces and their associated fields should merge at extremely high energies, meaning there is a unified, high-energy field already out there. If the new scalar field can use the Higgs to link up to this high-energy field, it could acquire some energy of its own.

**Energy seesaw**

The amount of energy would be determined by a seesaw mechanism: if the value of one field goes up, the other goes down. Since the unification field is so energetic, the new scalar field would be at very small energies. Krauss and Dent found that it would be the same order of magnitude as the observed dark energy.

"For the very first time for me, it shows that it's not unnatural to at least produce this really, really small energy scale, which otherwise is inexplicable in particle physics," says Krauss.

Wilczek, who was not involved in the new work, notes that although it offers a way to produce the amount of dark energy that we observe, it doesn't explain where the rest of the energy predicted by particle theories went.

"It's a question of what do you buy and at what price? It does not buy you an answer to the big question, which is how did everything else cancel out to get zero?" he says. "If it's right, it's a remarkable thing. But if it's wrong, I don't think anybody should be terribly upset."

(14 August 2013 New Scientist www.newscientist.com)

**Text 3**

## ODDBALL SPACE NEUTRINOS MAY BE SPAWN OF DARK MATTER

by Anil Ananthaswamy

The first deep space neutrinos to be detected since the 1980s may be the spawn of mystery dark matter. That would explain puzzling features of these particles – and suggest an unusual identity for dark matter.

Neutrinos, ghostly subatomic particles, are routinely produced by the sun and on Earth, but apart from those seen after a 1987 supernova explosion, none had been detected from beyond the solar system.

Then, earlier this year, the IceCube collaboration, which monitors a cubic kilometre of ice at the South Pole , reported two deep-space neutrinos, dubbed Bert and Ernie, each with a mass of about 1 petaelectronvolt (1015 electronvolts). These were quickly followed by reports of a bunch more, with masses of tens of teraelectronvolts (1012 eV), mass and energy being equivalent for particles.

Deep-space neutrinos are prized because they could allow "neutrino astronomy" – using neutrinos to investigate mysterious cosmic objects. Being chargeless, neutrinos zip from a source direct to Earth without being waylaid.

### Heavyweight particles

However, expected sources of such neutrinos, including energetic explosions called gamma-ray bursts or emissions from supermassive black holes called active galactic nuclei, should also produce  neutrinos of energies different from those seen by IceCube so far.

Pasquale Serpico of the University of Savoy in Annecy-le-Vieux, France, and colleagues wondered if the lack of these other energies could be a sign of decaying dark matter – the invisible stuff thought to make up about 80 per cent of the universe's matter.

They calculate that heavyweight dark matter particles of about 1 PeV would decay either directly into neutrinos of about 1 PeV, or into other particles and then into neutrinos with energies of tens of TeV. "It exactly reproduces the features that you see in IceCube," says Serpico.

This comes hot on the heels of recent reports from several dark matter detectors, which have seen signs of much lighter particles, with masses of about 10 gigaelectronvolts.

### Dark flavours

Tom Weiler of Vanderbilt University in Nashville, Tennessee, says there is no theoretical reason why dark matter shouldn't be heavy. The production of such particles would require more complicated mechanisms in the early universe, so theorists tend to prefer lighter particle candidates. "But Nature is the arbiter, not theorists," says Weiler.

Or the mysterious stuff might come in flavours – both light and heavy. "In general, the physics community prefers to have a single dominant dark matter [type], but it doesn't have to be so," says Serpico.

Francis Halzen, of the University of Wisconsin-Madison, and the principal investigator of the IceCube collaboration, isn't convinced by the new theory. The neutrinos seen by IceCube can still be explained by standard sources if the gap in neutrino energies goes away as the experiment collects more particles. "I do not think that anything in the data requires a more exotic explanation at this point," he says.

Dan Hooper, a theoretical physicist at Fermilab in Batavia, Illinois, agrees: "My money is on an astrophysical origin for these neutrinos, rather than dark matter."

Whether the neutrinos come from dark matter will become clearer as IceCube amasses more neutrinos and the gaps in energies either persist or vanish.

"If the hypothesis is correct, the birth of neutrino astronomy coincides with the discovery of dark matter," says Weiler.

(15 August 2013 New Scientist www.newscientist.com)

**Text 4**

**GRAVITY MAP REVEALS EARTH'S EXTREMES**

by Jacob Aron

Want to lose weight fast? No need to adjust your diet – just move to higher ground. This weight change is the result of fluctuations in Earth's gravity, which a new high-resolution map shows are greater than thought.

Gravity is often assumed to be the same everywhere on Earth, but it varies because the planet is not perfectly spherical or uniformly dense. In addition, gravity is weaker at the equator due to centrifugal forces produced by the planet's rotation. It's also weaker at higher altitudes, further from Earth's centre, such as at the summit of Mount Everest.

NASA and the European Space Agency both have satellites with highly sensitive accelerometers that map the planet's gravitational field, but these are only accurate to within a few kilometres. Adding in topographical data, which adjusts for height variations in local terrain, can improve the maps' resolution. Accurately constructing tunnels, dams and even tall buildings requires knowledge of the local gravity to guide GPS measurements of height, so higher resolution maps are important for civil engineering.

Christian Hirt of Curtin University in Perth, Western Australia, and colleagues combined gravity data from satellites and topographic data to map gravity changes between latitudes 60° north and 60° south, covering 80 per cent of Earth's land masses.

The map consists of more than 3 billion points, with a resolution of about 250 metres. Computing gravity at five points would take 1 second on an ordinary PC, but the team used a supercomputer to do the whole lot in three weeks.

Free fall favourite

The model pinpoints more extreme differences in gravitational acceleration than previously seen. Standard models predict a minimum gravitational acceleration of 9.7803 metres per second squared at the equator and 9.8322 $m/s^2$ at the poles. Hirt's model pinpoints unexpected locations with more extreme differences. Mount

Nevado Huascarán in Peru has the lowest gravitational acceleration, at 9.7639 m/s2, while the highest is at the surface of the Arctic Ocean, at 9.8337 m/s2.

"Nevado was a bit surprising because it is about 1000 kilometres south of the equator," says Hirt. "The increase in gravity away from the equator is more than compensated by the effect of the mountain's height and local anomalies."

These differences mean that in the unlikely event that you found yourself falling from a height of 100 metres at each point, you would hit the surface in Peru about 16 milliseconds later than in the Arctic. You would also lose 1 per cent of your body weight in moving from the Arctic to the Peruvian mountaintop, although your mass would not change.

<div align="right">(21 August 2013 New Scientist www.newscientist.com)</div>

**Text 5**

## STAR TWINKLES COULD HELP PIN DOWN PLANET SIZES

<div align="right">by Maggie McKee</div>

Twinkle, twinkle little star – and show us just how little you are. Starlight captured by the Kepler space telescope has revealed that the amount a star flickers is tied to its size, offering a better way to measure a wide variety of stars and their associated planets. Unfortunately, that may be mixed news for seekers of Earth-sized worlds.

Kepler was designed to spot transits, the periodic dips in a star's brightness indicating that a planet has passed in front of it. The telescope's vigil required exquisite targeting precision, and key parts of its steering system are now broken, ending the telescope's main mission as an exoplanet hunter. But you haven't heard the last of Kepler. Two years' worth of data still need inspecting, including information about the thousands of stars in its field of view.

Figuring out the properties of stars is vital to planet surveys. When a planet transits a star, the amount of light it blocks is used to calculate its size. That can help to pinpoint whether it is rocky like Earth or gassy like Jupiter – as long as the star's size is known.

Simply looking at a star's colour can reveal whether it is small and compact like our sun or big and bloated like a red giant, the type of star the sun will swell into in about 5 billion years. But such estimates are crude, with uncertainties of more than 90 per cent.

Much more accurate size and mass measurements, boasting uncertainties of just 2 per cent, come from studying vibrations within the star called starquakes. However this technique, known as asteroseismology, can be used only on bright stars, because it requires teasing out subtle periodic variations in a star's light.

**Getting granular**

Fabienne Bastien of Vanderbilt University in Tennessee and colleagues used Kepler data to watch instead for flickers in starlight due to short-lived convection

cells, or granules, on the star's surface. These are bright regions where hot plasma wells up, surrounded by darker boundaries where it cools and falls back down.

They began with a sample of about 500 stars whose size and mass were already known, thanks to asteroseismology measurements made by Kepler. They found a clear pattern: bigger, more bloated stars flicker more. That's probably because each granule spans some two dozen times the width of the Earth in a giant star, compared to just a fraction of the Earth's diameter in a compact star.

"What we see over time is the combined effect of this network of bright granules flickering on and off," says team member Keivan Stassun, also of Vanderbilt.

The method provides stellar size and mass estimates with uncertainties of about 25 per cent – a vast improvement over colour-based estimates, says Stassun. So far, the flicker technique has been used to find the size and mass of about 1000 stars that do not have asteroseismology measurements, and it could be used to gauge the sizes of 50,000 more stars already studied by Kepler, Stassun says.

### Fewer Earths

How will that affect the count of Earth-sized worlds? Kepler's principal investigator William Borucki expects the current pool of candidates to shrink. He suspects we may have been underestimating the size of stars, and therefore the planets that they host, so many worlds currently deemed "Earth-like" may turn out to be too big. "Based on previous experience, there is a significant chance that star sizes will increase when we have a more accurate method," he says.

Unfortunately, Kepler's pointing is probably no longer precise enough to measure the subtle flicker or asteroseismology signals from sun-like stars, says Jørgen Christensen-Dalsgaard of Aarhus University in Denmark, who leads a consortium of researchers who analyse Kepler's starquake data.

Still, the flicker method could be put to use on NASA's next planet hunter, the Transiting Exoplanet Survey Satellite (TESS), due to launch in 2017. "Our hope is that TESS will be able to do what Kepler has done, but over the entire sky," says Stassun.

(21 August 2013 New Scientist www.newscientist.com)


**Text 6**


## QUANTUM CHIP CONNECTED TO INTERNET IS YOURS TO COMMAND

by Jacob Aron


Quantum computing is in the cloud, and you don't need a degree in advanced physics to run your own programs. For the first time, anyone with a web browser will soon be able to log in and run basic algorithms on a quantum chip hooked up to the internet.

A quantum chip processes information in qubits, or quantum bits, which, unlike the digital bits in a regular computer, can be both 0 and 1 at the same time. In

theory, this ability should allow quantum computers to offer far speedier computation than current PCs – although devices that can definitely outperform standard machines don't yet exist.

Until now only a few labs around the world have had access to even basic quantum computers. Google recently purchased a D-Wave quantum computer and shares access with NASA and other select researchers, but not with the general public. Questions also remain over just how quantum D-Wave's machine really is, because it operates using a non-mainstream technique called adiabatic quantum computing.

Scientists at the University of Bristol, UK, were concerned that limited availability to any type of quantum computer would mean a dearth of skilled coders when the expected quantum revolution finally arrives.

"A quantum computer can do things faster for you, but someone has to program it, and at the moment there are only a handful of people around the world who would be qualified," says Bristol's Jeremy O'Brien, who led the development of the quantum chip being used in the cloud project.

### Quantum sim

The more traditionally quantum chip made at the University of Bristol works by guiding two photons through a series of optical channels. As the photons pass through the chip they become entangled, meaning that a measurement on one influences the outcome when measuring the other. Programming the computer involves tweaking the extent of this entanglement to produce different computations.

Would-be quantum coders will first use an online simulator that lets them practise programming. A tutorial explains the key quantum-mechanical ideas that are central to the device, then guides users through the steps required to adjust the chip and change its output. Once experienced enough, users can ask for permission to connect to the real chip, which is sitting in a lab in Bristol. It will run programs and return results via the internet.

"You can sit on the bus with your mobile phone and do a quantum optics experiment which might never have been seen before," says team member Peter Shadbolt. The simulator is already online, but the ability to directly access the chip won't launch until 20 September.

### Cloudy future

Exactly what a member of the public might want to use the quantum chip for is unclear. And the version being used online only has two qubits, so its processing power is a very limited.

"It's not going to calculate something that your PC couldn't calculate, because it's not at that scale by a long way," says O'Brien. His team has made 6-qubit and 8-qubit computers, but those projects are still in development. In the meantime, they are happy to let others use their older technology for free as a way to encourage engagement.

The beginnings of a quantum cloud should be a fun way to demonstrate the technology for the public, says Scott Aaronson at the Massachusetts Institute of Technology, who is not part of the project. And while a 2-qubit device won't be more

useful than your regular PC, putting it online might foreshadow how we will access large-scale quantum computers in future, he says.

"If quantum computing does become a practical technology, there will be a relatively small number of quantum computers, which people will access remotely."

(6 September 2013 New Scientist www.newscientist.com)

**Text 7**

## STRENGTH OF GRAVITY SHIFTS – AND THIS TIME IT'S SERIOUS

by Katia Moskvitch

Did gravity, the force that pins us to Earth's surface and holds stars together, just shift? Maybe, just maybe. The latest measurement of G, the so-called constant that puts a figure on the gravitational attraction between two objects, has come up higher than the current official value.

Measurements of G are notoriously unreliable, so the constant is in permanent flux and the official value is an average. However, the recent deviation is particularly puzzling, as it is at once starkly different to the official value and yet very similar to a measurement made back in 2001, not what you would expect if the discrepancy was due to random experimental errors.

It's possible that both experiments suffer from a hidden, persistent error, but the result is also prompting serious consideration of a weirder possibility: that G itself can change. That's a pretty radical option, but if correct, it would take us a step closer to tackling one very big mystery – dark energy, the unknown entity accelerating the expansion of the universe.

"If G has changed by this tiny amount then we would expect that G depends on a new field," says cosmologist Tony Padilla of the University of Nottingham, UK. "One could imagine a scenario in which this field plays a role in dark energy."

**Twisting wires**

According to Isaac Newton, the gravitational attraction between two objects is proportional to their masses and inversely proportional to the square of distance between them. G puts an absolute value on the attraction.

It was first measured in a laboratory in 1798 by British scientist Henry Cavendish using a device that determines the twisting of a wire due to the gravitational attraction of two pairs of precisely known masses.

Since then, other methods have produced a multitude of different values. This is assumed to be due to various experimental errors and the official value of G is routinely updated to reflect this, with the assumption that the values will eventually converge.

Now a team led by Terry Quinn of the International Bureau of Weights and Measures (BIPM) in Paris, France, and Clive Speake of the University of Birmingham, UK, has measured G using two methods: a modern version of the Cavendish experiment and one that relies on electrostatics. The resulting value for G is 240 parts per million bigger than the official one, set in 2010.

**Violets in springtime**

The figure alone is not the weird part - one recent measurement came up 290 ppm below today's official value. The strange thing about the latest one is that it is just 21 ppm off the value Quinn's team got using the same set-ups in 2001. Since the team took care this time around to remove every source of error that might have been at play back then, you would not expect the two results to be identical.

Quinn has arranged a special conference on G at the Royal Society in London in February to discuss the problem.

"This meeting is going to be very exciting," says James Hough, an experimental physicist from the University of Glasgow, UK. But he suggests carrying out the experiment a third time. "My own view is that the BIPM experiment needs to be copied exactly in another laboratory on a different continent by different experimenters initially to see if the same result is obtained," he says.

However, James Faller of the University of Colorado at Boulder, who tested G in 2010, is holding out for an error: "Errors are like violets in the springtime: they can spring up in any group's experiment," he says.

**Fifth force**

But the latest result could also be evidence that gravity itself may be changing.

"Logically, either some of the experiments are wrong, or G is not constant," says Mark Kasevich of Stanford University.

An oscillating G could be evidence for a particular theory that relates dark energy to a fifth, hypothetical fundamental force, in addition to the four we know – gravity, electromagnetism, and the two nuclear forces. This force might also cause the strength of gravity to oscillate, says Padilla. "This result is indeed very intriguing."

A further, less radical option is that G is still a constant but that Quinn's team has hit upon its true value. That would mean the actual value of G is higher than the official figure, which is interesting in itself, says cosmologist Clare Burrage of Nottingham University.

"If the value of G is slightly bigger, then we have to go back and redo all the calculations," she says. "Stars would burn up quicker than we previously thought because it takes more energy to push against a stronger gravitational force."

(11 September 2013 New Scientist www.newscientist.com)


**Text 8**


**PROTON SENT THROUGH LOOKING GLASS TO GAUGE ODDEST FORCE**

by Adam Becker


The proton, one of the fundamental building blocks of matter, has been sent through the looking glass. For the first time, physicists have measured how it is affected by the weak force, the only fundamental force to treat objects and their mirror images differently.

The result is consistent with the standard model of particle physics – something of a disappointment for those hoping nature's weirdest force would reveal something more exotic. But it's also a preliminary finding, so the force could yet point the way to new physics beyond the standard model.

Nature has four known forces – the electromagnetic force, which gives rise to positive and negative charge, gravity and the strong and weak forces. But the weak force, which acts only on the subatomic level and is responsible for radioactive decay, has an odd quirk.

If you're on a water slide, gravity pulls you along at the same rate, whether the slide turns clockwise or counter-clockwise. But in the subatomic equivalent of these situations, the weak force behaves differently. "If you do an experiment and compare it with a mirror-image of that experiment, you get different results," says Shelley Page, a physicist at the University of Manitoba, Canada, and part of the Q-weak collaboration, which made the latest measurement.

Physicists speculate that further examination of the weak force might hold clues to other exotic behaviour. They had previously measured its pull on other particles, including the electron, but had never managed to do the proton.

"We're looking for a sensitivity of this weak charge to something that might be there that isn't in the standard model," says Page. "If there's something out there that the proton could be feeling, that would show up as a difference between the proton's expected value and what we find."

**Switching spins**

Q-weak researchers measured the weak force's pull on the proton – a first – by taking advantage of this unique feature. Using equipment at the Thomas Jefferson National Accelerator Facility in Newport News, Virginia, they shot a beam of electrons at a target of protons while switching the "spin" – a quantum mechanical property – of the electrons between clockwise and counterclockwise, at a rate of 1000 times per second.

The behaviour of the electron beam was dominated by the electromagnetic attraction between the protons and electrons, with only a tiny influence from the weak force. But electromagnetism treats clockwise and counter-clockwise electrons the same way, unlike the weak force. So the Q-weak team subtracted the counter-clockwise behaviour from the clockwise behaviour, leaving behind nothing but the small effect of the weak force on the electrons' interaction with the protons.

They found that the "weak charge" of the proton, the weak force's analogue to the electric charge, was consistent with the prediction of the standard model, offering no immediate clues to new physics.

But Q-weak is still holding out hope of a surprise as the measurement is preliminary, involving only 4 per cent of their data. "This is a demonstration that you can measure the proton's weak charge, but to do the science Q-weak really wants to do, they're going to have to analyse the whole data set," says Bradley Filippone, a physicist at the California Institute of Technology who was not involved in the experiment.

Page agrees: "We weren't expecting to get a rigorous test until later," she says. "If the final measurement agrees with the standard model, fine. If it doesn't, that'll be very interesting."

<div align="right">(19 September 2013 New Scientist <u>www.newscientist.com</u>)</div>

**Text 9**

## WHAT HAS THE HIGGS BOSON DONE FOR US?

<div align="right">by Marcus Chown</div>

After all the excitement surrounding the discovery of the Higgs, a new book called Beyond the God Particle asks where we go next

IN 2012 American Independence Day was a high-water mark for European science: it saw the announcement of the discovery of the Higgs boson at the Large Hadron Collider, near Geneva, Switzerland.

For Leon Lederman, though, it was a low-water mark for American science. The Nobel prizewinning physicist is a former director of Fermilab, the Fermi National Accelerator Laboratory near Chicago. He is also the person who, tongue in cheek, gave the Higgs boson its "God particle" moniker.

In Beyond the God Particle, co-written with fellow particle physicist Christopher Hill, Lederman bemoans the short-sightedness of American politicians who pulled the plug on the Superconducting Supercollider (SSC) in 1993 and signalled the retreat of the US from the high-energy frontier of fundamental physics.

But while the US Congress may well have lacked what Lederman and Hill call "leadership cojones", it is perhaps unfair to blame Congress entirely. The plan for the SSC was to excavate a vast circular tunnel in Waxahachie, Texas, while the LHC plan proposed reusing an existing subterranean ring. Confining a superfast beam to such a small particle racetrack could be achieved only with superconducting magnets of such power that they were pure science fiction at the time the LHC was proposed.

In short, European scientists displayed the kind of daring, can-do spirit formerly seen in American scientists of the Apollo moon-shot era. As a consequence, and ironically, they presented their collective funding governments with a far lower total bill for the enterprise.

Although Lederman and Hill mourn the SSC, they seem to have accepted that European-style international collaborations with their pooled financial resources are the sensible way forward for particle physics.

Even so, they want to see the US punching its weight in particle physics again. In 2015, the LHC will start operating at even higher energies. Lederman and Hill suggest an American "Project X" to coincide with this, to look for ultra-rare, low-energy processes that may reveal a new fundamental physics.

It's a bold plan, and well argued, but the real meat of Beyond the God Particle is the Higgs boson itself and its raison d'être. And this is a truly fascinating story, well told.

Mass, in a nutshell, is not what you think it is. Not by a long chalk. According to Lederman and Hill, a subatomic particle such as a muon, which feels the weak

nuclear force, flickers back and forth between a right and a left corkscrewing form (the flicker is known as Zitterbewegung).

If, however, the muon could be boosted to the speed of light, its time would slow to a standstill, as predicted by Einstein's special theory of relativity. A particle that experiences no passage of time is a photon, so the muon would appear like a photon. Since a photon has no rest mass, running with the photon analogy, neither would the superfast muon. Its mass would have been "switched off". But all that has happened to it is that the flickering between left and right forms has stopped. The inference is that this oscillation is what gives a muon its mass.

So where does the Higgs come in? In switching from the left to the right form, a muon must destroy its "weak charge", which is as impossible as destroying the ordinary electric charge. Hence the left-right switch must be mediated by another particle that takes away the weak charge.

The particle is not obvious so it must be short-lived, which in quantum theory is synonymous with being massive. It cannot add electric charge, so it must have zero electric charge. And it cannot add quantum "spin", so it must have zero spin, making it a boson. Hey presto, the recipe for the Higgs.

According to Lederman and Hill, the defining characteristic of bosons is their gregariousness. Just like the photons that make up an electromagnetic field, the bosons of the Higgs field like to be with their mates, crowding the vacuum that fills the universe. And it is the drag exerted on a muon as it continually has to interact with Higgs bosons in the vacuum that endows it with mass.

But while photons are easy to pluck from the electromagnetic field, Higgs bosons are immensely hard to pull from their field. In fact, that takes a whopping 125 gigaelectronvolts to be precise – which is why nothing less than the $9 billion LHC could do it.

All of this is about as far from the standard cocktail party description of how the Higgs generates mass as it is possible to get. And it is worth the price of the book alone. Mind you, three-quarters of the way through, Lederman and Hill do belatedly admit, with a sheepish apology, that the Higgs explains only a minuscule part of mass. The lion's share – 99 per cent – comes from the strong nuclear force and has nothing whatsoever to do with the weakly interacting Higgs. But then, this fact has been omitted by almost all particle physicists in their eagerness to big up the Higgs to the media. Lederman and Hill's book is a great read and a mine of stuff you may not know about the standard model of particle physics and about the Higgs. In places, however, I found the explanations a little baffling: for instance, the description of the unobservable "gauge fields" that underpin our reality left me puzzled – and I have a background in physics. Also, we sometimes have to wait a little too long for an explanation of terms: "wave function", for instance, is defined nearly five pages after it is introduced.

As for what is beyond the God particle – the title of the book, after all – that turns out to be anyone's guess. Frustratingly, the Higgs has as yet provided no clues about the deep physics we did not already know. The outstanding question remains: if the Higgs gives other particles mass, what gives the Higgs its mass?

It is to answer this kind of question that Lederman advocates building a higher-energy machine in the shape of the International Linear Collider – probably in Japan – plus that American Project X, to look for oddball events at lower energies that do not fit the standard model.

But it's hard not to think that, as particle physicists make these grandiose plans, the universe looks on and mocks their efforts. After all, we now know that the stuff particle physicists are trying to understand accounts for a mere 4.9 per cent of the mass-energy of the universe. No one has the slightest idea about the true identity of the major components, dark matter and dark energy.

If anything, the discovery of the God particle has shown just how much further we have to go to penetrate the heart of nature. It all makes me think of the words of American poet Stephen Crane in A Man Said to the Universe:

A man said to the universe,
*"Sir, I exist!"*
*"However," replied the universe,*
*"The fact has not created in me A sense of obligation."*

(23 September 2013 New Scientist <u>www.newscientist.com</u>)

**Text 10**

## 2D PLANET LANDER AND SUSPENDED ANIMATION GET NASA CASH

by Jacob Aron

Space science just got a bit more far out. Paper-thin planetary landers that flutter down from space, suspended animation chambers  for future Mars travellers and 3D-printed body parts. These are just a few of the  ideas that will now receive cash from a NASA body tasked with looking at the future of space travel. Just don't expect to see results any time soon.

NASA's Innovative Advanced Concepts programme (NIAC) has selected 12 futuristic ideas to receive a $100,000 phase one grant each for further development. Researchers behind those that show promise can then apply for a further $500,000 in phase two. This year NIAC received more than 500 proposals before whittling them down to a select few.

"These new phase one selections include potential breakthroughs for Earth and space science, diverse operations and the potential for new paths that expand human civilization and commerce into space," said NIAC programme executive Jay Falker.

The hyper-thin, "two-dimensional" lander would be built from layers  of flexible electronics packed with power generators, sensors and communications devices. These would be dropped onto the surface of a planet from a passing spacecraft and simply flutter to the ground like sheets of paper.

**Astronaut metabolism**

The flat design could be cheaply and quickly printed on an ordinary 2D printer and negates the need for complex components such as propulsion or landing mechanisms, which have often failed on previous craft. Hamid Hemmati of NASA's

Jet Propulsion Lab (JPL) in Pasadena, California, who designed the concept, says hundreds of the landers could be dropped from orbit, creating a sensor network for gathering data across a whole planet.

Other ideas would see astronauts heading to Mars entering a suspended animation chamber designed to induce deep sleep states that reduce their metabolic rate and, as a result, also reduce the level of supplies needed for interplanetary travel.

Once on Mars, another proposal for 3D printing hybrid organic-inorganic materials would let astronauts replace parts of their spacesuit or even their own body.

**Metal hydrogen**

Previous NIAC projects include highly efficient rocket fuel made of metal hydrogen, electronic force fields that protect astronauts from radiation and using human waste to build radiation shields, which might be used by Inspiration Mars: a privately funded team planning a 2018 trip to the Red Planet.

None of the NIAC-funded proposals are expected to blast off in the near future, however. "NIAC studies are meant to be several years, perhaps a decade or even more, away from implementation," says NASA spokesperson David Steitz. "It is too early for any to have been fully implemented."

The programme was originally set up in 1998 as the NASA Institute for Advanced Concepts before shutting down in 2007 and relaunching in its new incarnation in 2011, so even the earliest ideas might not be ready for a while.

(23 July 2013 New Scientist www.newscientist.com)

**Text 11**

**THE EDGE OF REASON: WHEN LOGIC FAILS US**

by Richard Webb

*There are inherent limits to logic that can't be resolved, and they bedevil our minds too, says Noson Yanofsky in The Outer Limits of Reason.*

"THIS sentence is false." This sentence is also where the problems start. If true, it is false; if false, it is true. Extracting its true truth is like ironing out a Möbius strip. Things in the world we experience, however, tend to be distinctly one thing or the other. Language is a messy, human construct, so perhaps we shouldn't worry too much if it doesn't always map one-to-one with reality. But in The Outer Limits of Reason, Noson Yanofsky, an information scientist at the City University of New York, shows that our problems with reasoning about the world go much deeper than that. Mathematics is pure reason in symbolic form. Set theory, the underpinning of all modern mathematics, has an equivalent to that unreasonable sentence above in the form of Bertrand Russell's famous paradox: consider a set containing all sets that do not contain themselves. Does that set contain itself? Such logical limitations are systemic. Kurt Gödel and others showed that no set of fundamental mathematical axioms can be used to prove itself true. The logical axioms that underlie everyday things like arithmetic depend on us accepting as reasonable the notion that infinity comes in several different sizes.

Reason is even good enough to tell us there are things reason can't tell us. In the notoriously "hard" travelling salesman problem, there is always a shortest route connecting very many cities – but even the remorseless logic of a computer the size of the universe is never going to be able to crunch through the possibilities to tell us what it is. It is a problem logistics firms wrestle with every day.

Uncomputability isn't the half of it. Three-quarters of a century ago, Alan Turing asked if an idealised computer, given any algorithm and its input, would be able to predict whether it will halt on a given output, or go into a never-ending loop. The answer to this "halting problem" is no: computer self-analysis is logically fundamentally undecidable. Next time you are inclined to scream at Microsoft's blue screen of death, be charitable to Bill Gates.

Yanofsky provides an entertaining and informative whirlwind trip through limits on reason in language, formal logic, mathematics – and in science, the culmination of humankind's attempts to reason about the world. Themes emerge, such as the consistent sticking point of self-reference. The sentence that doesn't know whether it is true or not, Russell's set that doesn't know whether it contains itself or not, or the computer that doesn't know whether it is about to loop the eternal loop: these are all entities asked to decide logically something about themselves.

The same stumbling block might mean we can only take science so far. Quantum mechanics is our most successful theory of reality, bar none, and yet we find its predictions of particles that are in two places at once, or cats that are both dead and alive, "unreasonable". It is a challenge to our classically schooled logic.

But we cannot observe these predictions directly because, in quantum experiments, our act of observing something seems to change what's observed – we are ourselves part of the experiment. Is this the ultimate problem of self-reference, one that suggests a limit to how much we can ever reason about the world?

The problem of human consciousness looms large, not just in the quantum problem. In thinking about thinking we have to use thought. Our brains are computational machines like any other, and so presumably subject to the same fundamental limits on their ability to reason. So what allows the human mind to establish that there are limits beyond which it cannot think?

Yanofsky wisely and humbly declines to speculate on the answer. But a reader of this book will more readily understand what the question is.

And that sentence is true.

(4 November 2013 www.newscientist.com)


**Text 12**


**LIGHT CAN BREAK NEWTON'S THIRD LAW – BY CHEATING**

by Michael Slezak


Isaac Newton just got cheated. Laser pulses have been made to accelerate themselves around loops of optical fibre, seeming to break the physicist's law that every action must have an equal and opposite reaction. The work exploits a trick with

light that only makes it appear to have mass, so it is a bit of a cheat, but it may one day lead to faster electronics and more reliable communications.

According to Newton's third law of motion, when one billiard ball strikes another, the two balls should bounce away from each other. But if one of the billiard balls had a negative mass, then when the two balls collide they will accelerate in the same direction. This effect could be useful in a diametric drive, a speculative "engine" in which negative and positive mass interact to accelerate forever. NASA explored using the effect in the 1990s in a bid to make a diametric drive for better spacecraft propulsion. But there was a very big fly in the ointment: quantum mechanics states that matter cannot have a negative mass. Even antimatter, made of particles with the opposite charge and spin to their normal matter counterparts, has positive mass.

"Writing a negative mass in quantum field theory doesn't make any difference," says Archil Kobakhidze at the University of Sydney, Australia. The equations involve terms that are always squares of mass, so any negative mass will become positive anyway. "It has no observable meaning."

**Mass effect**

Now Ulf Peschel at the University of Erlangen-Nuremberg in Germany and his colleagues have made a diametric drive using "effective mass". As photons travel at the speed of light they have no rest mass. But if you shine pulses of light into some layered materials, such as crystals, some of the photons can be reflected backwards by one layer and then reflected forwards again by another. That delays part of the pulse, causing it to interfere with the rest of the pulse as it propagates more slowly through the material.

"It's a bit like what happens with a stroboscope," says Dragomir Neshev at the Australian National University in Canberra, who was not involved in the study. If you watch a spoked wheel turning under a strobe it can appear to move at a different speed or even backwards.

When a material slows the speed of the pulse proportional to its energy, it is behaving as if it has mass – called effective mass. Depending on the shape of the light waves and the structure of the crystal, light pulses can have a negative effective mass. But to get such a pulse to interact with one with a positive effective mass requires a crystal that is so long it would absorb the light before the two pulses could show a diametric drive effect.

To get around this, Peschel created a series of laser pulses in two loops of fibre-optic cable. The pulses get split between the loops at a contact point, and the light keeps moving around each loop in the same direction. The key is that one loop is slightly longer than the other, so light going around the longer loop is relatively delayed (see diagram, above right). When that pulse comes back around and splits at the contact point, it shares some of its photons with pulses in the other loop. After a few round trips, the pulses develop an interference pattern that gives them effective mass.

**Clever loops**

The team created pulses with positive and negative effective mass. When the opposing pulses interacted in the loops, they accelerated in the same direction, moving past the detectors a little bit sooner on each round trip.

"By having these loops you can loop it forever – it's equivalent to having enormously long crystals," says Neshev, whose group has also tried to create a diametric drive. "It is nice physics and a very clever apparatus."

Electrons in semiconductors can also have effective mass, so the loops could be used to speed them up and boost processing power in computers, says Peschel. And in some fibres the speed of a light pulse is equivalent to its wavelength, which means the loops could be used to control a fibre's colour output. Neshev says the method could increase the bandwidth of optical communications or even help create bright displays like laser screens. But he cautions that it will not be easy to adapt the loops for practical purposes.

(15 October 2013 [www.newscientist.com](www.newscientist.com))

**Text 13**

## ENTANGLED TOY UNIVERSE SHOWS TIME MAY BE AN ILLUSION

by Jacob Aron

Time is an illusion – at least in a toy model of the universe made of two particles of light. The experiment shows that what we perceive as the passage of time might emerge from the strange property of quantum entanglement . The finding could assist in solving the long-standing problem of how to unify modern physics.

Physicists have two ways of describing reality, quantum mechanics for the small world of particles and general relativity for the larger world of planets and black holes. But the two theories do not get along: attempts to combine their equations into a unified theory produce seemingly nonsensical answers. One early attempt in the 1960s was the Wheeler-DeWitt equation, which managed to quantise general relativity – by leaving out time altogether.

"It means that the universe should not evolve. But of course we see evolution," says Marco Genovese at the National Institute of Metrological Research in Torino, Italy.

In 1983 theorists Don Page and William Wootters suggested that quantum entanglement might provide a solution to the Wheeler-DeWitt "problem of time". When quantum objects are entangled, measuring the properties of one changes those of the other. Mathematically, they showed that a clock entangled with the rest of the universe would appear to tick when viewed by an observer within that universe. But if a hypothetical observer existed outside the universe, when they looked in, everything would appear stationary.

**Photon clock**

For the first time, Genovese and colleagues have demonstrated this effect in a physical system, albeit in a "universe" that contains only two photons. The team

started by sending a pair of entangled photons along two separate paths. The photons start out polarised, or orientated, either horizontally or vertically, and the polarisation rotates as both photons pass though a quartz plate and on to a series of detectors.

The entangled photons exist in a superposition of both horizontal and vertical states simultaneously until they are observed. But the thicker the plate, the longer it takes the photons to pass through and the more their polarisation evolves, affecting the probability that either one will take a particular value.

In one mode of the experiment, one of the photons is treated like a clock with a tick that can alternate between horizontal and vertical polarisation. Because of entanglement, reading this clock will affect the polarisation value of the second photon. That means an observer that reads the clock influences the photons' universe and becomes part of it. The observer is then able to  gauge the polarisation value of the other photon based on quantum probabilities.

Since photons passing through a thicker quartz plate experience a different degree of change, repeating the experiment with plates of different thicknesses confirms that the second photon's polarisation varies with time.

In another mode, the experimenter is a "super-observer" that exists outside of the universe, and so measures the quantum state of the system as a whole. From that vantage point, the state of both photons taken together is always the same, giving the appearance of a static universe.

**Quantum cosmos?**

"It's very nice these people have done an experiment to illustrate this effect and show how in practice it can occur," says Page, who  is now at the University of Alberta in Edmonton, Canada.

But not everyone thinks the Wheeler-DeWitt equation is the correct route to unification of the quantum and classical worlds, says Lee Smolin at the Perimeter Institute in Waterloo, Ontario, Canada. "They have verified in the context of a laboratory system that quantum mechanics is working correctly," he says. But Smolin argues that any correct description of the universe must include time.

Genovese acknowledges that the result does not cinch the issue. Instead,  he sees the work as a hint that quantum equations can in some ways mesh with general relativity, offering hope for a unified theory. The next step will be moving beyond the toy universe and seeing whether a similar effect scales up to explain what we see on a cosmic level.

"It's a visualisation of the phenomenon, it's not a proof," Genovese says of the experiment. "You should look to the universe itself for that."

(25 October 2013 www.newscientist.com)

**Text 14**

# THE MATHS THAT SAW THE US SHUTDOWN COMING

by Debora MacKenzie

*Can a new mathematical model predict the endgame of empires? Peter Turchin says his work shows why the US is in crisis, and what will happen next*

ON THE surface it seems inexplicable. The government of the most powerful country on earth has shut down and is dangerously close to defaulting on its debt. Its people and economy are feeling the consequences, and a new global financial crisis might not be far behind. And all this because a minority faction of one house of Congress will not approve a budget unless a healthcare measure that has already been passed into law is suspended.

But for Peter Turchin, a mathematical ecologist at the University of Connecticut in Storrs, the stand-off was predictable. He is one of a small group of people applying the mathematics of complex systems to political instability. They have been anticipating events just like this – and they say that if we don't find some way to respond to the warning signs and change course, things are bound to get a lot worse before they get better.

Turchin has found what he believes to be historical cycles, two to three centuries long, of political instability and breakdown affecting states and empires from Rome to Russia. In a book he is finishing, he argues that similar cycles are evident in US history, and that they are playing out to this day. He admits that his theory, built on a model that combines social and economic data, must be tested against real events – but unlike most historical theories, it can be. Meanwhile, he says, it "predicts the long-term conditions that led to this shutdown".

Workers or employees make up the bulk of any society, with a minority of employers constituting the top few per cent of earners. By mathematically modelling historical data, Turchin finds that as population grows, workers start to outnumber available jobs, driving down wages. The wealthy elite then end up with an even greater share of the economic pie, and inequality soars. This is borne out in the US, for example, where average wages have stagnated since the 1970s although gross domestic product has steadily climbed.

This process also creates new avenues – such as increased access to higher education – that allow a few workers to join the elite, swelling their ranks. Eventually this results in what Turchin calls "elite overproduction" – there being more people in the elite than there are top jobs. "Then competition starts to get ugly," he says. The richest continue to become richer: as in many complex systems, whether in nature or in society, existing advantage feeds back positively to create yet more. The rest of the elite fight it out, with rival patronage networks battling ever more fiercely. "There are always ideological differences, but elite overproduction explains why competition becomes so bitter, with no one willing to compromise," Turchin says. This means the squabbling in Congress that precipitated the current shutdown is a symptom of societal forces at work, rather than the primary problem.

In Turchin's theory, such political acrimony is paralleled by rising discontent among workers left with less and less, and increasing state bankruptcy as spending by the elite who control the government coffers spirals. Ultimately, the situation gets so bad that order cannot be maintained and the state collapses. A new cycle begins.

It may sound far-fetched. But in the last century, a slew of variables ranging from labour supply to public health indices, income inequality and the numbers and behaviour of the elite rose and fell in sync and as predicted by the theory. And with each glut of workers and peak in inequality came a surge in political violence.

Turchin finds that a simple mathematical model, combining economic output per person, the balance of labour demand and supply, and changes in attitudes towards redistributing wealth – the minimum wage level is one proxy for this – generates a curve that exactly matches the change in real wages since 1930, including complex rises and falls since 1980. Such close agreement between model and reality is exceptional in social sciences, says Turchin, and shows that all three factors control the rise of inequality, as predicted.

A set of 1590 instances of political violence in the US reveals peaceful periods around 1820 and 1950, with instability rising in between. Social data reflecting labour supply, inequality and elite overproduction match that basic fluctuation. Turchin thinks these changes explain the American civil war in the 1860s. The statistics also show that we are now in another phase of rising instability that began in the 1970s, just when, as his theory predicts, labour supply started outstripping demand.

In Turchin's theory, this phase in the cycle should also be marked by political polarisation and rising government debt – both current crises in Washington. Real wages, the minimum wage, trade union suppression, the share of wealth owned by the richest one per cent, even filibusters and fights over judicial appointments – all have changed at the same time in ways reflecting reduced social consensus. Meanwhile, the elite class has grown sharply. Between the 1970s and 2010, college fees rose, yet the numbers of doctors and lawyers qualifying per head of population nearly trebled. Workers have steadily lost out. The "real shocker", says Turchin, is that the average height of Americans peaked in 1975. It has actually declined in black women since then – a fact that could be down to falling nutrition standards linked to lower incomes. None of the trends shows any sign of reversing.

Yaneer Bar-Yam of the New England Complex Systems Institute in Cambridge, Massachusetts, agrees with Turchin's finding of repeated cycles in history. However, he believes our current experience also reflects something new: technology has brought about the emergence of a complex, networked society, one that, he argues, existing democratic institutions are too simplistic to govern.

"The fall of the Soviet Union wasn't the end of the story," says Bar-Yam. He says that the US government could also fall apart unless its citizens choose to adapt by evolving decentralised, networked institutions more suited to managing complexity.

Dirk Helbing of the Swiss Federal Institute of Technology in Zurich agrees. He says what's needed are fluid institutions that allow citizens to collaborate in a direct democracy to solve problems using next-generation social media. It works in a small

country like Switzerland, and the time is ripe for it to be exported to larger states. "The technology that allows this is growing," he says.

**Shutdown in the time of cholera**

What does a cholera outbreak in Mexico have to do with the US government shutdown? Plenty. The Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, would normally monitor the situation to help prevent the disease spreading across the border. But the shutdown has put the agency out of action.

The outbreak began just north of Mexico City in August and was exacerbated by flooding after Hurricane Ingrid last month. So far 75 cases have been reported in the state of Hidalgo, including one death, and two in Mexico City.

People who are apparently healthy can spread the cholera bug. The Mexican outbreak is related to the strain introduced into Haiti in 2010 by travellers who appeared well, and which has since spread to Cuba and the Dominican Republic. Cholera could therefore spread in the US for some time undetected, warns James Wilson, who heads Ascel Bio, an epidemiology consultancy in Delta, Colorado, that is tracking the Mexican outbreak.

In the absence of CDC monitoring, state public health agencies will do their best to be on the  lookout for unusual outbreaks. But they need federal leadership, says Wilson. "With CDC effectively offline for situational awareness, our country is missing that heads-up."

(10 October 2013 www.newscientist.com)


**Text 15**


**LIGHT-BENDING BLACK HOLE MIMIC IS FIRST YOU CAN WATCH**

by Jacob Aron


A plastic black hole traps light just like the real deal, and is the first such structure, natural or artificial, that you can actually watch in action. Unlike the real thing, it isn't dangerous – but it is helping to demystify one of nature's weirdest objects and might even have applications for energy-harvesting devices like solar cells.

Black holes are most famous for swallowing light, or anything else  in their path. But this fate only awaits objects that get sucked past a point called the event horizon.

Less well known is a black hole's photon sphere, a region of warped space-time outside the horizon that merely traps light in curved paths. Astronomers have never observed a photon sphere – even outside genuine black holes – because,  by definition, trapped light can't escape and reach your eyes so you can see it. So to visualise this process, Hui Liu at Nanjing University in China and colleagues built an artificial black hole.

In nature, black holes swallow and trap light via their immense gravity, something that would be difficult, not to mention incredibly dangerous, to recreate in the lab. Instead, Liu's team used a sheet of plastic – and mimicked the effect of

gravity by varying its refractive index, the property that determines how much a substance bends light.

**Making light curve**

The refractive index is different for different materials. That is why a straw poking out of a glass of water appears crooked: water bends light more than air, so has a higher refractive index. A material with a constantly varying refractive index would take this to the extreme, with lots of little bends creating a smooth curve – rather like a black hole's photon sphere.

Liu's team added quantum dots, tiny pieces of semiconducting material that fluoresce when illuminated, to molten acrylic glass, then poured the mixture onto a rotating quartz sheet, slowly spreading it out.

They placed a microscopic polystyrene sphere at the centre, which served as an anchor, with the material thickest nearest the sphere and thinning as it got further away. "This makes the effective refractive index vary in the same way the curvature of space varies around black holes," says Liu. In fact, the same Einstein field equations used to model black holes can describe the behaviour of light in the acrylic. Shining a laser through the material allows you to watch the artificial black hole in action – and to visualise other familiar gravitational effects.

Beams that are relatively far away from the microsphere are slightly bent towards it before continuing on their way. When gravity causes the same effect in space, it is known as gravitational lensing. This occurs whenever a light beam passes a massive object such as a star or galaxy, altering the beam's path as it travels along curved space-time- and can be used to get a better view of distant objects, such as exoplanets.

In the case of the artificial black hole, though, the pull increases as the laser moves closer to the polystyrene sphere, and eventually there is a point where it curves the light completely around. Previously artificial black holes have been created that mimic the event horizon of a black hole, in an attempt to detect a mysterious process called Hawking radiation – but this is the first artificial object to recreate the photon sphere.

**Visible sphere**

What's more, unlike a real black hole, the photon sphere can be imaged, thanks to the quantum dots. While the actual light that is trapped remains invisible, as in a real black hole, the quantum dots absorb some of it and emit red light at a different angle, allowing it to escape the black hole's grasp. This provides an exact trace of the true photon sphere's path and can be imaged by a camera.

"Our work reports a quite simple and ingenious method to mimic light trapping around a black hole," says Liu.

Ulf Leonhardt of the Weizmann Institute in Rehovot, Israel, who has previously created an artificial event horizon, says Liu's structure provides another way to study black holes. "It illustrates that there is no big mystery in the lensing effects in general relativity, you can do the same thing with ordinary materials."

Liu says the model could be used to study the effects of general relativity around a real black hole, but the ability to trap light could also have more practical

applications. "It could be quite useful for solar cells, photon detectors, microlasers and many other energy harvesting devices."

<div align="right">(29 September 2013 <u>www.newscientist.com</u>)</div>

## NEWS

**Text 1**

## IMF: GLOBAL ECONOMIC RECOVERY 'WEAKENING'

**The International Monetary Fund (IMF) has warned again of a weakening global economic recovery despite government efforts to stimulate growth.**

The global economy is likely to grow at a slower rate than previously forecast over the next two years, the organisation said in its latest report. It said it now expected the eurozone to remain in recession in 2013, having previously predicted growth.

The UK's growth forecasts have also been revised down. The IMF said continued problems in the eurozone were weighing on the global economy. "The euro area continues to pose a large downside risk to the global outlook," the IMF report said. "In particular, risks of prolonged stagnation in the euro area as a whole will rise if the momentum for reform is not maintained."

**Same challenges**

The eurozone's economy is now forecast to shrink by 0.1 % this year. Just three months ago the IMF had forecast 0.2 % growth. Earlier there were signs that some confidence had returned to European markets, with Portugal returning to the bond market to borrow money from investors for the first time since seeking a eurozone bailout in 2011. Its offering of 2bn euros of five-year bonds was four times oversubscribed by investors.

But overall, the IMF now forecasts that the world economy to grow by 3.5 % this year and 4.1 % in 2014, 0.1 percentage points lower than stated in October's forecasts.

Most of that growth is predicted to come from developing economies, rather than the developed countries still emerging from recession.

Earlier this month, the World Bank also cut its global growth forecasts blaming the slow recovery of developed nations.

The prospects for the UK's economy have also worsened in the last three months, the IMF forecasts suggest. Previously it forecast growth of 1.1 % this year and 2.2 % next year. That has now been revised down to 1 % and 1.9 % growth respectively.

The IMF said the challenges facing developed economies remained the same. "Most advanced economies face two challenges. First, they need steady and sustained fiscal consolidation. Second, financial sector reform must continue to decrease risks

in the financial system," the report said. "Addressing these challenges will support recovery and reduce downside risks."

(23 January 2013 http://www.bbc.co.uk/)

**Text 2**

## PRINCE HARRY VISITS HQ OF AUSTRALIAN SAS IN PERTH

**Prince Harry has honoured special forces soldiers killed in the line of duty during an unannounced visit to the headquarters of the Australian SAS.**

He joined families of fallen Special Air Service Regiment members to lay wreaths at Campbell Barracks in Perth.

Prince Harry was accompanied by Australia's Prime Minister Tony Abbott when he flew into the city for the last engagement of his 36-hour state visit.

He is now heading to a Dubai fundraiser for his aids charity, Sentebale.

Prince Harry, a captain in the British Army who has served twice in Afghanistan, met and had lunch with current and former members of the Australian SAS unit and toured their base.

Wreaths were laid in the Garden of Reflection at the barracks, and he also met members of groups which provide support to the unit.

The commanding officer, whose identity was only given as "Lieutenant Colonel G", said the unit was "humbled and grateful" that the prince had "made the time to join us".

"Prince Harry knows what it means to serve his nation on operations and most importantly what it means to the families of those serving," he said.

"Today's visit by His Royal Highness and the prime minister represents a unique opportunity to recognise the broader SAS regimental family that provides the back-up and support at home.

"Families play a critical role for those serving in the SASR, and indeed the whole of the Australian Defence Force, and we are thankful that the families of some of our serving, former and fallen members were able to be here today."

On Saturday, Prince Harry begun his first official trip to Australia by joining celebrations to mark its navy's arrival at Sydney Harbour 100 years ago.

He attended the International Fleet Review, featuring some 40 warships from 17 countries, including the Royal Navy's type 45 destroyer, HMS Daring.

Thousands of people flocked to the harbour as Prince Harry met crowds before boarding a boat for a reception with Mr Abbott at his official residence in the city.

(6 October 2013  http://www.bbc.co.uk )

**Text 3**

## TORY MP ADAM AFRIYIE TRIES TO FORCE EARLY EU REFERENDUM

**Prominent Conservative backbencher Adam Afriyie has said he will try to force the government to hold an early vote on whether the UK should leave the EU.**

The prime minister has promised to hold an in/out referendum in 2017 if he wins the next general election, but Mr Afriyie said voters were "not convinced" that it would happen.

He said he would push for a vote in October 2014 instead.

But Home Secretary Theresa May warned that Mr Afriyie had "got it wrong". And a Downing Street spokesman said of Mr Afriyie's plan: "The PM will not let it stand."

Mr Afriyie - who has denied newspaper claims he is being groomed to replace party leader David Cameron - said he would table an amendment to the European Union (Referendum) Bill on Monday.

**'Absolutely delighted'**

Mr Cameron has pledged to renegotiate the UK's relationship with the EU before an in/out referendum in 2017.

But, speaking on the BBC's Sunday Politics programme, Mr Afriyie said there would be "ample time" to conduct this renegotiation by as early as next year. "By having a referendum in 2014, it gives us 12 months to renegotiate," he said. "But more than that, it kick-starts negotiations."

We will not allow this amendment to be passed under any circumstances - the PM will not let it stand"

And Downing Street spokesman EU member states would need to "accommodate" British demands for reforms "if they wish us to remain", he added.

He argued: "I think it strengthens the prime minister's hand."

The MP said 80% of people wanted a referendum, and more than 50% of people wanted a referendum this side of the election. "British businesses need certainty," he said. "Look, we can carry on kicking this can down the road forever.

"But I've had a struggle with my conscience over this one. "I don't want to cause any trouble over it, but I think it's absolutely essential that Parliament and MPs have the opportunity to search their souls and to give people a referendum this side of the election."

In an article for the Mail on Sunday, he predicted that - without a referendum before 2015 - "large numbers of people will continue to vote UKIP whatever happens - and if they do, there is a distinct danger that Labour will gain a majority and we will never see a referendum at all".

UKIP leader Nigel Farage said he would be "absolutely delighted" if Britain could have an early referendum.

He told the BBC's Andrew Marr programme on Sunday that a referendum before 2015 would be good for British industry and business.

"Adam Afriyie has put his finger on the real problem - and that's that four years ago, Mr Cameron gave us a cast-iron guarantee that there would be a referendum.
"This time last year, he was saying there would not be a referendum, and he is now saying there should be a referendum. "People are not quite sure what to believe."

But Mrs May, speaking on the same programme, said: "We need to be negotiating that settlement with the European Union and then put to the  British people the Europe of the future - not the Europe of the past - and give them that opportunity to say in or out.

"What is crucial is that we have, at the next election, a Conservative party that will be offering people that renegotiation of a new settlement with Europe, looking to the future and then putting that to the British people in an in/out referendum."

Backbench Conservative MP James Wharton is attempting to enshrine  his party leadership's referendum pledge in law - without the support of coalition partners the Liberal Democrats - with his European Union (Referendum) Bill.

As a private member's bill, it is vulnerable to being delayed by procedural tactics from MPs who oppose it, and will only become law if the  government allocates enough parliamentary time for its proponents to overcome any such hurdles. Mrs May warned that Mr Afriyie's amendment to the bill could "jeopardise" its prospects entirely.

And Mr Wharton told BBC Radio 5 live the amendment could "kill" his bill.
"My concern is that any amendment, no matter how well-meaning it might be, is going to make the progress of the bill more difficult and it'll make it easier for those MPs who want to use procedural techniques to slow it down and stop it... that bit more possible.

"I don't want to see that. I'd like to see my bill go through and I think this harms the chances of that happening."

Liberal Democrat deputy leader Simon Hughes, whose party opposes a referendum on the EU unless further powers are handed from Westminster to Brussels, said a 2014 referendum would be a "barmy" distraction from the government's attempts to boost UK economic growth.

Deputy Prime Minister and Lib Dem leader Nick Clegg said the Conservative leadership had scheduled a referendum in 2017 due to "internal party management as much as anything else".

The PM's promise of a "grand, unilateral renegotiation of Britain's relationship with the EU" was "deeply flawed and bound to unravel", he added, in pre-released extracts of a speech to be delivered in London on Tuesday.

The European Union (Referendum) Bill is due to return to the House of Commons for further debate on 8 November.

(6 October 2013  http://www.bbc.co.uk/)

**Text 4**

## US GOVERNMENT SHUTDOWN HALTS EU FREE TRADE TALKS

Negotiations on a sweeping free trade pact between the US and the EU have been postponed because of a partial government shutdown in America.

US officials had been due in Brussels next week to discuss the deal aimed at boosting bilateral ties.

US President Barack Obama earlier cancelled his trip to Asia because of the shutdown.

The US government closed non-essential operations on Tuesday after Congress failed to agree a new budget.

Since then hundreds of thousands of government employees have not been working or paid.

**'Unfortunate'**

On Friday, US trade representative Michael Froman informed the EU that financial and staffing constraints made it impossible to send a full negotiating team to Brussels.

But he stressed that Washington would continue working with the EU on drawing up the deal, but would have to wait until the shutdown was over.

Reacting to the US announcement, European Trade Commissioner Karel De Gucht said the delay was unfortunate.

"But let me underline that it in no way distracts us from our overall aim of achieving an ambitious trade and investment deal," he added.

Meanwhile, the White House said that Mr Obama would miss two summits in Asia, including the Asia-Pacific Economic Co-operation (Apec) meeting in Indonesia.

It said the decision was made due to the "difficulty in moving forward with foreign travel in the face of a shutdown".

Mr Obama called Indonesian President Susilo Bambang Yudhoyono on Friday and expressed his regret over the cancellation, Indonesian presidential spokesman for foreign affairs Teuku Faizasyah told the BBC.

The visit had not been rescheduled, the spokesman added.

Secretary of State John Kerry will attend the Apec gathering and the East Asia summit in Brunei in Mr Obama's place, the White House said.

President Obama had been due to begin a four-nation Asian trip on Saturday, heading to Bali and Brunei before travelling on to Malaysia and the Philippines.

The US government partially shut down operations on Tuesday after Republicans who control the House of Representatives refused to approve a budget, saying they would only do so if Mr Obama's healthcare reform law was delayed or stripped of funding.

Mr Obama and the Democrats have refused, noting the law was passed in 2010, subsequently approved by the Supreme Court, and was a central issue in the 2012 election which Mr Obama won comfortably.

On Friday, Democrats and Republicans appeared no closer to finding a way out of the impasse.

Republican House Speaker John Boehner insisted Mr Obama and Democratic Senate leaders open negotiations on the shutdown.

"All we're asking for is to sit down and have a discussion," he said. "This isn't some damn game."

Mr Obama later said he was happy to hold talks with the Republicans, "but we can't do it with a gun held to the head of the American people"."This shutdown could be over today," he said. "We know there are the votes for it in the House of Representatives. If Speaker Boehner will simply allow the vote to take place, we can end this shutdown."

The US also faces running out of money and defaulting on its debt if there is no agreement to raise government borrowing limits later this month.

**'Worse than 2008'**

IMF head Christine Lagarde says it is "mission critical" that the situation is resolved. Christine Lagarde, managing director of the International Monetary Fund (IMF), said warned earlier that a failure to raise the US debt ceiling would be a far worse threat to the global economy than the current shutdown. She said it was "mission critical" that the US agreed a new debt limit.

Ms Lagarde's comments were echoed by the US Treasury. It said a debt default could lead to a financial crisis as bad as 2008 or worse.

Meanwhile, the impact of the shutdown was being felt across the country. The National Transportation Safety Board did not send investigators to a deadly church bus crash in Tennessee that killed eight people and injured 14 others.

The labour department also postponed the release of the highly anticipated September jobs report.

With Tropical Storm Karen bearing down on the Gulf states, the website of the National Oceanic and Atmospheric Administration (NOAA), carried a message saying: "Due to the federal government shutdown, NOAA.gov and most associated web sites are unavailable."

It referred visitors to the National Weather Service.

However, the Federal Emergency Management Agency (Fema) recalled workers to help prepare for the storm.

On Friday, House Majority Leader Eric Cantor said the House would vote on a measure to re-open Fema as well as the National Weather Service to deal with the impending storm.

Are you in the US? Are you affected by the government shutdown? You can send us your comments using the form below.

(5 October 2013  http://www.bbc.co.uk)

**Text 5**

## OBAMA BLAMES BOEHNER FOR ONGOING GOVERNMENT SHUTDOWN

**(CNN)** -- President Barack Obama in an exclusive interview with the Associated Press released Saturday laid responsibility for the government shutdown squarely at the feet of House Speaker John Boehner.

"We can vote to open the government today," Obama told the Associated Press in the wide-ranging interview. "We know that there are enough members in the House of Representatives -- Democrats and Republicans -- who are prepared to vote to reopen the government today. The only thing that is keeping that from happening is Speaker Boehner has made a decision that he is going to hold out to see if he can get additional concessions from us."

Much of the government has been shut down -- more than 800,000 workers furloughed, national parks closed, programs for programs from child care to space exploration shuttered -- for five days. And it's likely to remain closed for several days if not weeks more, House Republicans concede.

Despite public pressure to reach a resolution -- and statements from politicians that they want to -- Washington's political machinery has been gridlocked.

And there's little indication there will be any breakthrough until at least mid-October, when the next economic crisis comes up over whether Congress will give the federal government the OK to increase how much it can borrow or default on its debt.

Obama, in the AP interview, said he did not expect the latter to occur.

"There were at least some quotes yesterday that Speaker Boehner is willing to make sure that we don't default," he said in the interview, which was taped Friday. "And just as is true with the government shutdown, there are enough votes in the House of Representatives to make sure that the government reopens today.

"And I'm pretty willing to bet that there are enough votes in the House of Representatives right now to make sure that the United States doesn't end up being a deadbeat. The only thing that's preventing that from happening is Speaker Boehner calling the vote."

Boehner, speaking to reporters Friday, tried to ratchet up pressure on Obama to end the crisis by acceding to his demand that he negotiate changes to Obamacare as part of any deal. Fuming about a Wall Street Journal report that cited an unidentified Obama administration official as saying "We are winning," Boehner said, "This isn't some damn game!"

Much of the opposition to the administration's efforts has been led by sympathizers of the tea party, who are seeking a reduction in the national debt and the federal budget deficit, as well as a reduction in U.S. government spending and taxes. Asked whether the tea party members are good or bad for the country, Obama told the AP he was more concerned about their tactics than about their positions.

"It's this idea that if they don't get 100% of their way, they'll shut down the government or they'll threaten economic chaos," he said. "That has to stop."

**Obamacare glitches**

The government shutdown occurred when Obama refused to give in to Republican demands that he delay or change the Affordable Care Act, the signature achievement of his first term that began enrolling patients on October 1.

Obama said he did not know how many people had signed up for the plan, also known as Obamacare. He acknowledged that computer glitches have snarled the process for some, but urged them not to give up.

"My message to them would be, each day the wait times are reduced," he said. But the program is not going to be affected by the budget negotiations, he said. "The obsession with the Affordable Care Act, with Obamacare, has to stop," he added. "That is not something that should be a price for keeping the government open."

Obama contrasted his own low-profile behavior during his single term in the Senate with that of some current first-term senators, who include Republicans Ted Cruz of Texas, Marco Rubio of Florida and Rand Paul of Kentucky -- all of whom have been outspoken in their opposition to Obamacare.

"I didn't go around courting the media, and I certainly didn't go around trying to shut down the government," he said. "And so I recognize that in today's media age, being controversial, taking controversial positions, rallying the most extreme parts of your base -- whether it's left or right -- is a lot of times the fastest way to get attention or raise money, but it's not good for government. It's not good for the people we're supposed to be serving."

**Thoughts on Iran**

The AP interview also touched on the question of Iran's nuclear program and the overtures made last month by President Hassan Rouhani at the U.N. General Assembly meeting in New York.

"Nuclear weapons and other weapons of mass destruction have no place in Iran's security and defense doctrine, and contradict our fundamental religious and ethical convictions," Rouhani told the world body.

Obama said the United States should test such overtures.

"I think Rouhani has staked his position on the idea that he can improve relations with the rest of the world," Obama said. "And so far, he's been saying a lot of the right things. And the question now is, can he follow through?"

Obama said the U.S. view is that Iran is at least a year away from being able to produce a nuclear weapon, double the six months cited this week by Israeli Prime Minister Benjamin Netanyahu, who has expressed deep distrust of Tehran's intentions -- calling Houssani "a wolf in sheep's clothing."

"What I've said to Prime Minister Netanyahu is that the entire point of us setting up sanctions and putting pressure on the Iranian economy was to bring them to the table in a serious way to see if we can resolve this issue diplomatically," Obama said. "And we've got to test that. We're not going to take a bad deal. We are going to make sure that we verify any agreement that we might strike."

**One more thing ...**

Though much of the interview focused on the sport of politics, it ended on the politics of sport. Asked about the Washington Redskins, a name some people

consider to be insulting to Native Americans, the nation's first black president said he would be open to changing the name if he owned the team.

"I don't know whether our attachment to a particular name should override the real, legitimate concerns that people have about these things," he said. But Obama added that there was little chance he would wind up owning a football team. If he were to own any professional sports team after leaving the presidency, Obama said, it would more likely be a basketball team.

(5 October, 2013 http://edition.cnn.com/)

**Text 6**

**CRUZ PROMISES REPUBLICAN VICTORY IN SHUTDOWN FIGHT**

**Richmond, Virginia (CNN)** – Texas Sen. Ted Cruz, blamed by Democrats and some of his fellow Republicans as a chief architect of the ongoing government shutdown, struck back on Saturday, faulting President Obama and Senate Democrats for the political stalemate.

"Let me be very clear, I don't think we should be in a shutdown," Cruz said in a speech to conservatives in the Virginia state capital. "Throughout the course of it, I have said we should not shut down the government. But sadly this is Harry Reid's and President Obama's shutdown."

The government shutdown began Tuesday when the president refused to give in to Republican demands that he delay or change the Affordable Care Act, the signature achievement of his first.

In the run-up to the shutdown, Cruz - whose profile has risen considerably among conservatives since taking office this year - had lobbied Republicans in the House and Senate not to relent, even as the president was promising not to sign any bill that would alter "Obamacare."

Cruz reminded the audience that House Republicans have passed multiple "narrowly targeted continuing resolutions" to fund parts of the government as negotiations continue, but he criticized Democrats for refusing to pass them.
He said Senate Democrats are "dug in." "We are in the midst of a battle," Cruz said. "Their position is untenable right now."

Cruz, who spoke without notes for nearly an hour, said Republicans would win the shutdown fight but offered little in the way of concrete solutions.

"How do we win?" he asked. "If you trust the media, if you trust the voices in Washington, if you even trust, god forbid, some of the elected Republicans in Washington, they say we can't win this fight. The only way to win this fight is the way we won every other fight throughout the history of the republic, which is solutions don't come from Washington, D.C., they come from the people."

"Career politicians in both parties have gotten us into this mess," he said. "But it's going to be the American people who get us out."

According to a CBS News poll released this week, 72 % of Americans disapprove of the shutdown, and more Americans blame Republicans in Congress than Obama.

But the audience inside a convention center ballroom here was firmly behind Cruz, interrupting his speech frequently with applause.

"It's about time that someone abandoned the notion that compromise is the best way to win," said Rev. Mark Morrow, the Williamsburg pastor who introduced Cruz, a freshman senator who was elected in 2012 with tea party backing.

Throughout his remarks, Cruz made clear he cares little for the approval of his colleagues in Washington, Republicans included."There are so many elected officials in both parties that desperately crave the adulation of the media and the intelligentsia," he said.

Virginia's Republican candidate for governor, attorney general Ken Cuccinelli, spoke earlier in the program, an appearance that had consumed the governor's race all the week.

Democrats, betting that Cruz's uncompromising behavior in Washington is toxic to moderate voters in a state whose economic health is tied to the federal government, have been working overtime  to portray Cuccinelli as a close ally of Cruz.

His Democratic opponent in the governor's race, Terry McAuliffe, has accused Cuccinelli of being Robin to Cruz's Batman, even running a television ad this week saying that "Ted Cruz's tea party shutdown is hurting Virginia."

Cuccinelli, whose fortunes depend on turning out conservative base voters on Nov. 5, has been reluctant to criticize his  fellow Republicans, including Cruz, over the shutdown.

But his aides have been at pains to put some distance between the Republican candidate and Cruz, noting that his appearance here was not an official campaign event, and that he and Cruz were invited separately to the gala.

Before the event, Cuccinelli and Cruz crossed paths and chatted briefly backstage. A Cuccinelli aide told reporters that Cuccinelli urged Cruz to find a solution to the shutdown.

During his brief remarks, Cuccinelli made no reference to Cruz, and he departed from the convention center soon after leaving the stage.

Cruz, though, lavished praise on Cuccinelli, who was the first state attorney general in the country to sue the federal government over the Affordable Care Act.
"Let me just say for a second how proud I am of my friend Ken Cuccinelli," Cruz said. "He is smart, he is principled and he is fearless."

(5 October, 2013 http://politicalticker.blogs.cnn.com)

**Text 7**

## IRELAND WILL NEED EU SUPPORT WHEN BAILOUT ENDS THIS YEAR, SAYS IMF

### International Monetary Fund report warns that poor state of Irish banks is holding back recovery

A slowing economy, sky-high debts and a weak banking sector mean Ireland will need support from the European Union when its current bailout ends later this year, the International Monetary Fund said in a report on Friday.

In a clear call for Brussels to accede to Irish demands for a credit line next year, the IMF warned that Dublin's recovery would be hampered without cheaper funding for its ailing banks.

The report will deal a blow to the Irish government, which is under pressure domestically to maintain business and consumer confidence in the face of significant economic headwinds. In particular, export growth, which has underpinned the economy's recovery, has fallen in 2013.

The IMF said that while exports had picked up moderately in recent months, the recovery would not stop Ireland's debts hitting 123% of GDP by the end of the year. Making matters worse, the poor state of the country's banks is holding back the domestic economy.

"Irish banks face weak profitability that hinders their capacity to revive lending. European support to lower banks' market funding costs could help sustain domestic demand recovery in the medium term, protecting debt sustainability and financial market confidence," it said.

The IMF has conducted 11 reports on Ireland's economic recovery since it joined a three-way bailout of the country with the EU and the European Central Bank in 2010.

Ireland would be the first bailed-out eurozone country to wean itself off emergency aid if it exits the €85bn scheme on schedule at the end of this year. The IMF said Dublin was on track to meet its obligations under the deal, but "near-term prospects are weaker and significant fiscal, financial sector and unemployment challenges remain".

Ireland was forced to seek help after a property crash left its banks massively under-capitalised and the state's finances collapsed. Since then it has stuck rigorously to the recipe of austerity laid out in the programme by its "troika" of lenders.

The EU is desperate for Ireland to exit the rescue smoothly to show the tough-love approach can succeed, given the struggles of fellow bailout recipients Greece and Portugal and deep-rooted public dissatisfaction across the region.

Ireland has met nearly all its funding needs through next year by issuing debt periodically over the last 12 months, having issued a 10-year bond in March for the first time since being locked out of markets in late 2010.

Yet banks continue to shun calls from households and businesses for easier credit conditions while struggling with low profits and a ratio of bad loans that has reached 26%.

Unemployment also remains a huge problem. A fall in the jobless rate from 15% to 13.7% since early 2012 has eased the social security burden but 58% of those without work are considered long-term unemployed, "posing a risk to Ireland's growth potential", said the IMF.

(4 October 2013 http://www.theguardian.com)


**Text 8**


## PENTAGON ORDERS 'MOST' OF 400,000 FURLOUGHED EMPLOYEES BACK TO WORK

**Defense Department does not provide details regarding which employees, among whom are NSA workers, will return**

The Pentagon is ordering most of its approximately 400,000 furloughed civilian employees back to work. The employees have been away from work as part of the ongoing government shutdown, which is the result of a standoff between Congress and the Obama administration over healthcare laws, government spending and the debt limit.

The decision to order the furloughed workers back, which was made by the defense secretary, Chuck Hagel, is based on a Pentagon legal interpretation of a law called the Pay Our Military Act. That measure was passed by Congress and signed by President Barack Obama shortly before the partial government shutdown began Tuesday.

Earlier this week, the National Security Agency, which operates under the jurisdiction of the Defense Department, furloughed an undisclosed number of employees. The Pentagon did not immediately say on Saturday exactly how many workers would return to work, and in which areas. It said "most" employees were being brought back.

"I expect us to be able to significantly reduce – but not eliminate – civilian furloughs under this process," Hagel said. "Employees can expect to hear more information from their managers starting this weekend."

Hagel also cautioned that while he would be able to bring back civilians, the "ay Our Military Act did not allow for the Defense Department to pay for some supplies necessary for many of them to do their jobs.

"Critical parts, or supplies, will run out, and there will be limited authority for the department to purchase more," Hagel said. "If there comes a time that workers are unable to do their work, I will be forced once again to send them home."

On Saturday, the House of Representatives passed a bill to retroactively reimburse 800,000 furloughed federal workers for pay lost in the government

shutdown. The bill, which is supported by the Democratic-controlled Senate and the Obama White House, passed unanimously, 407-0.

(5 October 2013 http://www.theguardian.com)

**Text 9**

## DAVID CAMERON UNDER NEW PRESSURE TO HOLD EU REFERENDUM BEFORE ELECTION

### Former Labour minister Tom Watson adds to Tory calls for vote before 2015

David Cameron is under fresh pressure from both sides of the house to call an EU referendum before the election, as the prominent Labour MP Tom Watson joined a Tory campaign for an early vote.

Watson, a former Labour minister and campaign director, said he was planning to support Adam Afriyie, a Tory backbencher, who is leading calls for an in-out poll before 2015.

The move has been firmly rebuffed by No 10, which said the prime minister would in no circumstances allow a referendum before he had had a chance to renegotiate Britain's relationship with EU. Cameron is supporting a bill by James Wharton, a backbencher, which sets out a plan to hold a referendum before the end of 2017.

However, Afriyie is not satisfied with this timetable, arguing that voters are suspicious that they are not being allowed to have a say on Britain's EU membership straight away. He is planning to table an amendment to Wharton's bill calling for a referendum on 23 October 2014.

The Windsor MP has been the subject of speculation that he would like to be leader of the Conservative party. Speaking on Sky News's Murnaghan programme, he said it was "media tittle-tattle" that he wanted to succeed Cameron and insisted he was loyal to the leadership, but said he could not "sit quietly" while the referendum was put off until 2017.

Watson added fuel to the row by saying "a lot of people" in both Labour and the Conservatives wanted a referendum sooner.

"I don't want to add to the PM's panic, but I will probably be supporting Adam Afriyie with his amendment," he told the BBC's Andrew Marr Show.

"I think there are a lot of people on both sides of the house who think we need clarity on this now. The country has asked for it for a long time, business has been saying there's a lot of uncertainty and parties have got to draw up their manifestos for the 2015 general election and they will be very difficult, depending on the outcome of a referendum."

Watson's move will also add to pressure on Ed Miliband, the Labour leader, who has not yet made it clear his views on a vote.

"He's kept his options open. He's said he will take that decision at a later date, but I just don't know," Watson said. "It would be down to him and Douglas Alexander but now I'm on the backbenches, I think I might support Adam."

A number of Tories argue an early EU referendum would stop voters turning to the UK Independence party in 2015 if they do not believe Cameron will stick to his promise after the election.

Afriyie claims delaying a poll poses "significant dangers", including building support for Ukip, and argues he has the support of "many MPs from across all the main parties" for an early referendum.

"It's in our national interest to resolve this issue as soon as possible to create the certainty and stability our country needs for the future," he wrote in the Mail on Sunday.

"Only by setting an early date can we kickstart EU renegotiation talks and give the British people what they so clearly want – a say on our country's future with Europe.

"The political establishment are naturally hesitant but we have nothing to fear by giving people a chance to have their say, either way, on our future relationship with Europe."

Questioning Cameron's tactics, he wrote: "The fact is, the British people are not convinced there will be a referendum at all if we wait until after the next general election.

"So many things can change. They don't understand why we can't have one right away – and that makes them suspicious. "Many people think delaying the vote is just a tactic to allow all the political leaders to kick the can even further down the road."In reality, the British people are unsure whether the Conservative leadership would be able to stick to its promise of holding a referendum after the election, especially if in coalition once again."

Despite his protestations of loyalty, Afriyie's move is being seen as a challenge to Cameron's authority.

Speaking on the BBC's Marr Show, Nigel Farage, the Ukip leader, dismissed the prime minister's promise of a poll before 2017 as a way of "kicking the issue into the long grass".

However, Theresa May, the home secretary, defended the government's plans, saying Cameron was planning a "serious negotiation" before taking the option of a new settlement to the British people.

The European Union (referendum) bill easily cleared its first Commons hurdle in July after Labour and the Liberal Democrats avoided voting on the issue.

Wharton said the rebel amendment would "make it far more difficult to navigate the challenging procedural hurdles we need to overcome and I hope its sponsors might rethink their approach".

"We need to build as broad a base of support for the bill as we can if we are to get it through parliament and the policy of a renegotiation, followed by an in-out referendum, is the right one to do that and the right one for the country.

"I hope MPs will decline to support it as the ultimate impact might well be to kill my bill, which would only help those who don't want any referendum at all."

Ed Miliband and Nick Clegg have dismissed the bill as a stunt designed to shore up the prime minister's position with his rank and file – pointing out that it has virtually no chance of becoming law.

In May, 115 Conservative MPs backed a rebel amendment to the Queen's speech criticising the failure to include a referendum bill in the government's legislative programme.

Cameron said that was impossible because of being in coalition with the pro-European Lib Dems, but has thrown his weight behind Wharton's bill.

(6 October 2013 http://www.theguardian.com)

**Text 10**

## LIBYA DEMANDS EXPLANATION FOR 'KIDNAPPING' OF CITIZEN BY US FORCES

**Demand comes hours after separate failed US military raid on terrorist target in Somalia**

Libya has demanded an explanation for the "kidnapping" of one of its citizens by American special forces, hours after a separate US military raid on a terrorist target in Somalia ended in apparent failure and retreat. In Tripoli the US army's delta force seized alleged al-Qaida leader Nazih Abdul-Hamed al-Ruqai, known by his alias Abu Anas al-Liby and wanted for the 1998 bombings of the US embassies in Kenya and Tanzania that killed more than 220 people.

But US navy Seals suffered a major setback when they launched an amphibious assault to capture an Islamist militant leader said to be Ahmed Godane, described as Africa's most wanted man and the architect of last month's attack on the Westgate shopping mall in Kenya. The elite Seals were beaten back by heavy fire and apparently abandoned equipment that the Somali militants photographed and posted on the internet.

As dramatic details of Saturday's twin operations emerged, US secretary of state John Kerry insisted that terrorists "can run but they can't hide" , but faced growing questions about America's military reach in Africa and the consequences of unilateral aggression.

Al-Liby was captured outside his family home at 6.15am in Noufle'een, a quiet suburb in eastern Tripoli, according to witnesses, but there were conflicting reports over who took him. His brother, Nabih, told the Associated Press that al-Liby was parking when a convoy of three vehicles encircled his car. Armed gunmen smashed the car's window and seized al-Liby's gun before grabbing him and taking him away, the report said. The brother said al-Liby's wife saw the kidnapping from her window and described the abductors as foreign-looking armed "commandos".

But al-Liby's son Abdullah insisted that Libyan forces were involved. Appearing on Tripoli's Nabir TV station, he said: "The people who took my father were Libyan, not Americans – they spoke with Tripoli accents.

"My mother was listening to the voices in the street and could see it all through the window. There were two cars and a bus with blacked-out windows and no number plates."

He said his father was dragged from his car and arrested as it was still moving, and the vehicle, driverless, continued driving empty down the road.

Al-Liby, who was believed to be a computer specialist for al-Qaida and lived in Manchester in the UK during the 1990s, is believed to be 49 and on the FBI's most-wanted list with a $5m (£3m) bounty on his head. He is "currently lawfully detained by the US military in a secure location outside of Libya," Pentagon spokesman George Little said.

Libya's government refused to say whether its forces were involved in the arrest and claimed it had not been informed in advance. A statement from prime minister Ali Zaidan said: "The Libyan government is following the news of the kidnapping of a Libyan citizen who is wanted by US authorities. The Libyan government has contacted to US authorities to ask them to provide an explanation."
Thousands of miles away in Somalia, US special forces carried out a raid that was no less audacious but had a very different outcome. It was reportedly planned a week and a half ago in response to the Nairobi attack and came 20 years to the week since an American mission that infamously went awry when Somali fighters shot down two Black Hawk helicopters.

Members of Seal Team Six – the unit that killed al-Qaida leader Osama bin Laden in his Pakistan hideout in 2011 – swam ashore from speedboats before members of the Islamist militant group al-Shabaab rose for dawn prayers, officials and witnesses said. They stormed a two-storey beachside house in Barawe said to be occupied by foreign members of al-Shabaab and battled their way inside, a fighter who gave his name as Abu Mohamed told the AP.

There was a heavy gun battle at around 2.30am on Saturday, according to locals in Barawe, 118km south of the capital Mogadishu. Mohamed Hassan, a schoolteacher, said: "Nearly an hour before the morning prayer I heard dogs bark and I got up, but within minutes I heard small gun fire towards the direction of the beach. I raised my ears up as the shooting continued and continued. Soon it became like an exchange of fire. Then I heard one big explosion and two other explosions occurred. I could not go outside so I remained in my room to wait what was happening."

Hassan said the shooting he could hear was that of al-Shaabab's fighters because he understood the US forces were using silencer guns so no one could hear their shooting. "In the morning, we saw people gathering near the house the US forces targeted and there was a lot of blood everywhere. The al-Shabaab fighters told us not to go to the direction of the house. I saw one dead and two others injured but they were not very critical."

No one in Barawe town could have imagined such an attack, he added, and they kept saying only "white solders attacking Barawe town". Local residents said late on Saturday that al-Shabaab deployed additional fighters in Barawe to keep guard at the beach where the navy Seals landed.

US officials told the Associated Press that the Seal team encountered fiercer resistance than expected, so after a 15- to 20-minute firefight, the unit leader decided to abort the mission and they swam away.

A local resident, Haji Nur, said he saw military equipment which al-Shabaab claimed to have confiscated from the white soldiers. "I saw in the centre of the town a crowd of people gathering in one place and looked at three rounds of M16 ammunition, one US-made hand grenade and one also a bullet-proof jacket."

Al-Shabaab, which has a formal alliance with al-Qaida and claimed responsibility for the Nairobi mall killings that killed at least 67 people, posted what it claimed were pictures of the equipment on the web.

Sheikh Abdiasis Abu Mus'ab, a spokesman for al-Shabaab, said: "Early on Saturday morning, around 2am, white soldiers attacked a house resided in by some members of the Mujahideen leaders in Somalia. They came from a waiting speedboat from warship and as they were approaching the house, our Mujahideen fighters repulsed them. They ran away. We chased them until they have reached the seaside where they urgently boarded their speedboats."

Mus'ab said one al-Shabaab member had died and claimed that the Seals lost a "senior officer". US officials said there were no US casualties in either the Somali or Libyan operation.

A resident of Barawe who gave his name as Mohamed Bile told the AP that militants closed down the town in the hours after the assault, and that all traffic and movements have been restricted. Militants were carrying out house-to-house searches, likely to find evidence that a spy had given intelligence to a foreign power used to launch the attack, he said.

A Somali intelligence official was quoted as saying that Ahmed Godane, the al-Shabaab leader also known Mukhtar Abu Zubeyr, was the target of Saturday's raid. Mohamed Ansari, a former al-Shabaab member now working with Somalia's counter-terrorism unit in Mogadishu, said: "Godane is the only big fish in Barawe to hunt. Godane as the top leader of al-Shabaab and the only planner of the group's operations is seen as the mastermind of Westgate mall siege in Nairobi."

Unlike his Libyan counterpart, Somali prime minister Abdi Farah Shirdon welcomed the US intervention. "We have close cooperation with the world, especially the western countries in the fight against al-Shabaab," he said in Mogadishu on Sunday. "We welcome any operation to hunt the terrorist leaders and we are at the forefront. Al-Shabaab is a Somali problem, a regional problem and world problem."

The dual raids were a vivid of expression of how the US has quietly been building its military capacity in Africa. Kerry, who is in Indonesia for an economic summit, said: "We hope that this makes clear that the United States of America will never stop in the effort to hold those accountable who conduct acts of terror. Members of al-Qaida and other terrorist organisations literally can run but they can't hide."

But a diplomatic source focused on Somalia said: "This is knee-jerk stuff and smacks of a massive failure of intelligence. Are extrajudicial killings and covert

kidnapping raids the best way of dealing with the problem? Why is the international response so feeble?"

But Dr Adekeye Adebajo, executive director of the Centre for Conflict Resolution in South Africa, said that while it was in the interest of African governments to fight terrorism, he does not "think the heavy-handed and unilateral way the US acts is helpful and it risks causing further instability, especially where there are weak governments like in Libya and Somalia".

(6 October 2013 http://www.theguardian.com)

## ТЕКСТИ ДЛЯ САМОСТІЙНОЇ РОБОТИ

**Text 1**

## INTERACTION AND VISUALIZATION OF 3D VIRTUAL ENVIRONMENTS ON MOBILE DEVICES

By Jose´ M. Noguera • Juan C. Torres

### 1. Introduction

The advent of low energy-consumption Graphics Processing Units (GPUs) [1] has boosted the graphics capabilities of mobile devices, opening the door to the development of interactive 3D applications that were inconceivable just a few years ago [2]. The mobile market is strongly competitive, and an attractive visual interface is an important advantage in creating a successful device. As a result, mobile device manufacturers have rapidly adopted this new hardware, and the market is demanding new applications featuring advanced 3D graphics and interactive virtual worlds.

This scenario opens a wide and interesting research area. Virtual reality applications, until now limited to desktop computers, can now take full advantage of the unique attributes provided by mobile computing: ubiquity, connectivity, context-awareness, and multimodal interfaces. However, these advantages come at a cost. By definition, mobile devices must be small and powered by batteries. These two factors severely limit both their computing power and graphics capabilities. As applications require the handling of larger and more complex 3D scenes, more intelligent and power-efficient techniques will be required. In addition, the nature of handheld devices raises new unprecedented usability issues. The small display sizes, coupled with the limited input technologies, motivate the study of new ways of interacting with the 3D applications.

The goal of this theme issue of *Personal and Ubiquitous Computing* is to investigate the implications of adopting 3D graphics and virtual environments in the field of mobile computing. The papers collected in this issue present current research efforts and useful applications that employ 3D graphics with particular focus on addressing the unique features of mobile devices.

Submissions to this theme issue came from an open call for papers. We selected five papers to publish after two rounds of rigorous reviews. A large number of reviewers assisted us in the review process. In order to ensure high reviewing standards, three to four reviewers evaluated each paper.

## 2. The papers of the theme issue

The five papers selected can be grouped into three categories: 3D visualization techniques, augmented reality (AR), and interaction methods.

An interactive user experience through complex 3D worlds requires the ability to render the scene to an acceptable number of frames per second while keeping image quality as high as possible. The first two papers are primarily devoted to addressing this issue from a technical point of view. Both papers provide client – server alternatives designed to bypass the mobile device limitations in order to handle complex 3D graphics under different scenarios.

• The paper "A scalable architecture for 3D map navigation on mobile devices" by Noguera et al. describes a 3D map streaming system for mobile phones. Interactive 3D maps are undoubtedly an interesting application for these devices, as they constitute an effective means of accessing location based services (LBS) and other spatial data. This paper addresses several practical problems, including a client – server architecture for providing 3D maps to a large number – hundreds – of commodity mobile devices with just one server. The paper reports the overall architecture, implementation, and empirical performance evaluation. It finishes with a user study that evaluates the quality of the 3D map from a qualitative point of view.

• The following paper "Interactive visualization of medical volume models in mobile devices" by Campoalegre et al. studies the problem of volume rendering of medical data sets on mobile devices. Volume rendering is essential to several applications in medicine that require the visualization of medical imagery. Until recently, these applications were limited to desktop computers. Mobile devices, however, are easier to carry in certain scenarios, such as teaching laboratories or operating theaters. The paper proposes a client – server solution designed to overcome these devices' intrinsic memory limitations. More specifically, the paper addresses two problems: data transmission to the mobile client and decompression of data for efficient rendering.

## 3. Conclusion

Collectively, these papers provide a compelling overview of some of the latest work in this area and can give a lot of insight into how to create interesting 3D applications for mobile devices. The popularity and increasing graphics capabilities of these devices clearly show that, if correctly used, they can afford a new range of possibilities. We do hope that the papers included in this special issue will be inspiring and satisfying for the audience of the PUC Journal and hopefully lead to even greater innovation in the field.

(Published online: 29 August 2012 Personal and Ubiquitous Computing Abridged)

**Text 2**

## DEVICE-INDEPENDENT ARCHITECTURE FOR UBIQUITOUS APPLICATIONS

By Jacek Chmielewski

### 1. Introduction

The term Internet of Things (IoT) is usually used to describe systems composed of multiple sensors and actuators. According to Marc Weiser's [1; 2] 'invisible servant' rule, these devices should operate in the invisible (calm) way influencing the real world, but not interacting directly with people. People only notice the results of device activities rather than the devices themselves. However, this is not the only side of the IoT. According to the definition provided by EC [3], the IoT also includes all the devices used directly by people: smartphones, tablets, smart TV, intelligent home appliances, public interactive touch panels, etc; essentially, any electronic device connected to the Internet and used to interact with a user. Such devices may provide a number of sensors, but the main differentiator is that they provide user interaction channels (UICs) that allow interacting directly with a user, not only with the environment surrounding the user. In this paper, we focus on this side of the IoT, and to differentiate from sensors and actuators, we call these devices *end-devices*. *End-devices* are used by users to access applications that expose their functions using user interfaces (e.g., visual representation of buttons on a touch screen or vibration as a tactile feedback). In this paper, users of these applications are called *end-users*, and consequently the applications are called *end-user applications*.

The growing number of software platforms and increasing diversity of end-devices [4; 5] make the development of end-user applications a difficult and time-consuming task. Developers can either target only a few most popular platforms excluding some end-users and limiting the reach of their end-user applications or develop a large set of separate end-user applications targeting different platforms and end-device classes. Despite being economically hard to justify, the provision of application functionality to end-users using a wide range of end-devices will become even more difficult as new software platforms emerge and gain acceptance (Windows Phone, bada, Firefox OS, Tizen) and new classes of end-devices connect to the Internet – not only smartphones and tablets, but also car infotainment systems (BMW ConnectedDrive), smart TVs (Samsung SmartTV), intelligent home appliances (LG Smart ThinQ series), interactive coffee tables (MS PixelSense), etc. In consequence, there is a need for a more universal approach to the implementation of end-user applications – an approach that will lower the development effort and will make end-user applications easily accessible to end-users despite the diversity of end-devices. One way to make it possible is to build applications that are independent of end-devices. With such a device-independent approach, developers need to implement only a single version of an application and end-users are not tied to a specific device – they may use their applications on any suitable end-device. Essentially, the device independence would help make end-user applications ubiquitous.

The remainder of this paper is organized as follows.

Section 2 contains some background information on how device independence is addressed in today's solutions. In Sect. 3, the Device-Independent Architecture (DIA) is introduced and described. Section 4 contains a description of an experiment verifying the feasibility of the Device-Independent Architecture. Section 5 concludes the paper and provides an overview of future research directions. (…)

## 2. Device independence

Device independence means that functions of an end-user application are available on any suitable end-device without the need to modify the application itself. Commonly, the device independence is achieved by separating the application from lower layers of the device.

Separation from the hardware can be provided by an operating system (OS) [6]. An OS abstracts device hardware features using device drivers and delivering hardware- related functions in a form of an API. Applications using the API are hardware independent, but become OS dependent. There is large number of different OSs available on the market, and each OS has its own API and its own limitations to software platforms that can be used by developers. Therefore, the introduction of the OS as a separation layer does not provide true device independence – it does not allow building ubiquitous end-user applications.

Separation from the diversity of OSs can be provided by an additional layer – universal runtime environment (URE) such as Java Virtual Machine, Flash engine or a Web browser. UREs are available on multiple different OSs and are characterized by the fact that they wrap the OS API with their own API. Also, UREs usually limit development options to a specific programming language (e.g., Java, ActionScript, HTML5/JavaScript). Applications developed for a particular URE are hardware and OS independent, but become dependent on the availability of the URE. With the increasing number of mobile devices such as smartphones and tablets [4] and declining support for many once-popular universal runtime environments [7], the Web emerges as a leading platform for device-independent applications [8; 9]. Therefore, most of the current research on device-independent applications is focused on various aspects of Web applications: from differences among Web browsers [10], to new HTML5 APIs, CSS3 properties and crossbrowser Java Script libraries that try to unify [11] and enhance Web browser behavior [12], to new server-side frameworks [13].

However, the main problem with the Web-based approach is that it requires powerful end-devices capable of supporting all separation layers, Web runtime and additional JavaScript libraries. The resource constraints are especially important for embedded and mobile devices. Embedded devices usually have limited processing capabilities, which makes them a hard target for Web applications (cf. webinos efforts to put their runtime on Arduinobased devices [12]). On the other hand, mobile devices may have powerful processors, but they depend on battery life which can be significantly limited by increased processing requirements of Web applications. This is one of the reasons why Apple mobile devices never supported Flash technology [14].

Achieving the device independence of end-user applications by introduction of additional separation layers seems to be a dead-end – especially for the billions of

mobile and embedded IoT end-devices. To get past those limitations, we propose a new architecture for device-independent applications, which ensures application-device separation also in the field of constrained device resources. (…)

**5. Conclusions and future research**

The DIA, presented in this paper, is a response to the opportunity provided by the multitude of smart end-devices that compose the IoT – an opportunity that can result in development of truly device-independent and ubiquitous applications. The main idea behind the DIA is to move the processing out of end-devices to a cloud-based infrastructure and to introduce a set of protocols and services that separate applications from end-devices and provide support for development of multi-device applications. The presented experiment confirms that the DIA is a viable concept and that it provides the assumed benefits. The original application analyzed in the experiment was limited to smartphones running the MS Windows Phone 7 OS and the transformation into a device-independent application according to the DIA concept made the application available on any end-device featuring the set of necessary, but common, features: a screen, a geolocation service, a touchscreen, a camera and a microphone.

The DIA approaches the problem of application device independence from a new perspective and opens a wide range of new research topics. From provision of continuous and stable device connectivity, to detection of device availability crucial for multi-device usage scenarios, to UI abstraction, adaptation and distribution issues. The presented DIA is an extensible solution and enables enhancements that provide additional functions. This creates an opportunity for new services that would help better support device-independent and multi-device applications: application markets and catalogs, private application repositories, third party services for gathering and sharing user preferences, device usage billing and micropayment services (provided, for example, by telecom operators), etc.

Each of these topics is a challenging task on its own. To succeed in this broad field, a coordinated research effort is required. We believe that the concept presented in this paper provides a solid framework for future research in the field of device-independent applications and will eventually ease the burden of developing truly ubiquitous applications that efficiently use capabilities of multiple devices.

(20 March 2013 Personal and Ubiquitous Computing
Abridged)

**Text 3**

**A NOVEL CONCEPT OF A WEARABLE INFORMATION APPLIANCE USING CONTEXT-BASED HUMAN–COMPUTER INTERACTION**

By Antti Ropponen • Matti Linnavuo • Raimo Sepponen

**1. Introduction**

**1.1. Background**

In many health and security services, such as hospitals and those which care for the elderly, individuals are monitored. Monitored issues may include the location or

health status, for example heart rate [1; 2], breathing [3] or the movements [2] of a person. According to the results of the monitoring, alarms are produced to attract the care personnel's attention in situations when actions are required.

The situation may be as simple as helping the patient to the bathroom or more serious, for example assisting in an accident such as a fall.

Often the main task of the staff is not to respond to alarms. This is why the alarm management and forwarding should be as ergonomic and non-intrusive as possible. The staff should be informed promptly, get the contextual information of the situation and be able to decide how to react. An efficient alarm management system benefits from context-based information, such as the location of the incident, patient data and locations of the personnel.

Several methods of alarm forwarding have been introduced, ranging from nurse call systems in hospitals to alarm bracelets for independently living seniors.

The user interface may be a wall display, PDA, mobile phone, beeper or pager [22]. Often the user interface exploits devices and services which are not designed for that purpose, for example a mobile phone using SMS messages.

The use of commercially available user interfaces, however, has some constraints and limitations in applications, usability and ergonomics [4].

## 2. Materials and methods

### 2.1. Requirements

The alarm management user interface should be able to indicate an alarm and forward the user response to it. It should also be able to give the system the location of the employee and display context-based information like patient records or ward directions. The three major strands of data that should be accessed with a PDA in a hospital environment are [11] the following:
• Patient records, laboratory results, etc.
• Location of patients and colleagues
• Location of medical equipment, beds, etc.

The preliminary RFID system could locate patients, nurses and ward equipment [5]. In the new tag, a larger display and a more versatile button arrangement have been introduced.

### 2.2. Name tag approach

The main idea in the user interface is that the display is manipulated automatically using wireless networks. When the system has identified the tag and located it, the user interface can be changed using the context-based information.

Automatic mobile tour guides use similar methods [12; 13]. For example, next to a door the tag changes to an ''open'' button, and next to a hospital bed the tag changes to show the patient's records. When the system changes the tag's user interface automatically using location information, there is no need for complex tree structures [14; 15]. With mobile phones, many steps have to be made, for example, to create a new SMS (Short Message Service) or to connect to the internet. In hospitals or homes for the elderly, nurses and doctors have no time in emergency situations to push many buttons and follow complex user interface trees to signal alarm and get help.

In hospitals and other healthcare institutions, the doctors and the nurses have enough things to carry. That is why it might be hard to persuade them to carry yet another gadget.

The tag that is used to respond to different alarms should also be within easy reach. The solution is to have a multifunctional name tag that hospital staff carry with them at all times. The personal data  are displayed by default on the tag screen (Fig. 3), but depending on the context, the user interface can change to display  data records, etc.

## 2.3. User interface of the tag

In mobile device user interface design, there are three major categories that have to be taken into account [16]:

• Interaction mechanisms

• Utilizing screen space

• Design at large (to be explained in Sect. 2.5)

The best interaction mechanism for the tag may be a touch screen. A normal keyboard would need either a great number of buttons or different functions assigned to the same button in different situations, which would make it complex to use. With a touch screen, only the buttons that are  needed can be shown and a button can display information about the action that follows (Figs. 4, 5). Because the tag is used in a healthcare environment, it has to be operated by finger. In emergency situations, there is no time to try to find any special pointing equipment. This fact rules out all the touch foils that, for example, require a stylus pen.

To use the screen space efficiently, each set of data should be adjusted to the size of the display. Any zooming should be avoided. The user is not expected to use the device sitting at a table and might even be moving when using it. In order to keep one hand free, for example to push a hospital bed or open doors, it should be possible to use the device with one hand or with one thumb. As we can see from Fig. 6, all the buttons should be rectangular and almost as wide as the screen to be easily reachable with either thumb. This one-hand approach also imposes restrictions regarding scrolling. For example, scrolling from top left to bottom right for right-handed users, and vice versa, should be avoided [17]. Horizontal scroll bars should be avoided with a mobile device in any case [16].

Using a keyboard, for example to fill patient records, is also a problem because it is difficult and slow to type text with a small touchpad keyboard [18]. A better approach could be to use the device as a dictating machine and later write down the information using a standard computer keyboard.

## 3. The concept system

## 3.1. Test installation

A concept system was built to test the concept where a name label changes to a multifunctional tag. The system comprised three units: A NFI system was used to locate a person and excite the RFID tag; the existing RFID tag [39] was used for location and identification source; and an iPod Touch multimedia player (Apple Inc., California, USA) was used as the multifunctional name label. iPod Touch multimedia player is approximately  the same size as a normal name tag, it has a 3.5-inch

capacitive touch screen and WLAN (Wireless Local Area Network) radio to communicate with the NFI system [35].

The display of the multifunctional name label was changed according to the location information from the NFI system. The tested case had two AAs in the room where the tag changed the mode. In the first area, the tag changed to a screen with information about a fictitious patient. In the second area near the door to the  room, the image on the tag changed to number buttons. In both cases, when the active area was left, the tag changed back to a name label.

The displayed user interface was actually a web page that could be manipulated by a small extension in the NFI system program. This way, a separate user interface program was not needed. Furthermore, web pages are easy to build and modify.

The iPod's web browser opened a CGI-script (Common Gateway Interface) from the server of the NFI system. The script sent back a page that consisted of control and content frames. The control frame decided which content frame appeared on the page. The content frame included the actual information and all the functions (buttons) for the user. In this way, the NFI system could select the content frame that appeared on the iPod's screen and completely different pages could be displayed without changing the actual page address. First, the CGI-script loaded the default frame to the browser (the name tag, Fig. 8) and opened a connection to the NFI system location engine.

When a person came into a room, the NFI system observed him/her and triggered the NCL scan. If a tag was found, the NFI person location cell  was identified (Fig. 7).

The web page that the iPod opened had a common uniform was connected with the identification. When the NFI system saw the person approach the bed, the patient information appeared on the iPod (Fig. 9). When the person left the AA, the name tag appeared on the screen again.

The same thing happened again when the person went near the door with the exception that this time the code buttons were loaded.

(Published online: 20 November 2011 Personal and Ubiquitous Computing
Abridged)


**Text 4**


## EDUCATIONAL COMMUNICATION TECHNOLOGY (ICT FOR EDUCATION)

by Youqun Ren


Educational communication technology is a very dynamic area of research and application; new products can become out of date within a matter of months. The popular press often disseminates stories that dwell on the novelty rather than on the practicality of a new technology. Decision makers and those responsible for procurement are presented with a dilemma regarding acquisition of newer, forward-looking but riskier technologies as opposed to the reliable, older but more mature technologies. As is shown by the many chapters pertaining to emerging technologies,

innovations ranging from cloud-based technologies to tablet applications are undoubtedly worthy of our attention due to their educational potential. However, the maturity of a technology and its connection and compatibility with existing technologies and expertise present significant challenges. When venturing to deploy a new technology, there are usually many unknown factors and some risk (Spector, 2012). When a new technology is profoundly different from previous technologies, or when the application of the technology dramatically changes practices, there are bound to be a multitude of unexpected problems.

In addition to the constant change of educational technologies, there is another challenge – namely differences between theory and practice, along with differences between the natural sciences and the humanities. A new educational technology that works well in support of learning physics may not work as well in support of learning philosophy, and vice versa. Moreover, the relevant learning theories and paradigms might be quite different in different areas of application. Effective technology integration requires sensitivity to the potential of various technologies as well as a profound understanding of speci fi c disciplines and associated pedagogical practices. In too many cases, educators adopt without hesitation a new technology only to see it fail in practical use. As a community of professional practitioners, we are slowly coming to the realization that new tools need to be tested in the real and somewhat uncontrolled and chaotic circumstances in which everyday learning and instruction occur. Educational technology researchers and developers should carefully observe, assess, and identify the adaptability and success of the new technologies in light of actual teaching and learning; furthermore,all must keep in mind the opportunities, the bene fi ts, the constraints, and the risks.

Compulsive and hasty adoption of a new technology will very likely result in another cycle of sweet expectation followed by bitter disappointment.
Another important issue is the boundary between the two academic disciplines of educational technology and computer science. They are distinct from each other; however, a typical program of educational technology often offers many courses that are also found in a computer science curriculum. A closer scrutiny, however, reveals that educational technology courses are quite different from apparently  similar
courses in a computer science department. A recent IEEE-sponsored report recommends a very specific, cross-disciplinary curriculum for advanced learning technologists that could, if adopted, reduce the tensions between computer science and educational technology as separate and competing disciplines (Hartley, Kinshuk, Koper, Okamoto, & Spector, 2010). As things now stand, educational technology graduates find themselves at a disadvantage in the job market in comparison with a computer science graduate who appears equally well qualified. This state of affairs affects the growth of the discipline adversely.

To avoid this waste of resources and dashed expectations, the discipline of educational technology needs to enhance its own reputation as a separate and credible area of expertise, which is what Hartley and colleagues (2010) encourage. That is to say, advanced learning technology graduates need to command abilities and skills that neither computer scientists nor education degree holders possess. However, they should be able to communicate and collaborate with both computer scientists and

professional educators. In short, there is a need for a careful scrutiny of the field and a re-delineation of its academic scope and theoretical systems, along the lines of the Hartley et al. (2010) report, which identified the following domains of competence for educational technologists:

1. Knowledge competence – includes those competences concerned with demonstrating knowledge and understanding of learning theories, of different types of advanced learning technologies, technology-based pedagogies, and associated research and development.

2. Process competence – focuses on skills in making effective use of tools and technologies to promote learning in the twenty- fi rst century; a variety of tools ranging from those which support virtual learning environments to those which pertain to simulation and gaming are mentioned.

3. Application process – concerns the application of advanced learning technologies in practice and actual educational settings, including the full range of life-cycle issues from analysis and planning to implementation and evaluation.

4. Personal and social competence – emphasizes the need to support and develop social and collaboration skills while developing autonomous and independent learning skills vital to lifelong learning in the information age.

5. Innovative and creative competence – recognizes that technologies will continue to change and that there is a need to be flexible and creative in making effective use of new technologies; becoming effective change agents within the education system is an important competence domain for instructional technologists and information scientists.

(Handbook of Research on Educational Communications and Technology)


Text 5

## NANOTUBE-COATED SPIDER SILK CAN SENSE YOUR HEARTBEAT

by Eden Steven, Wasan R. Saleh, Victor Lebedev, Steve F. A. Acquah, Vladimir Laukhin, Rufina G. Alamo,& James S. Brooks

**Introduction**

The immense demand for electronics, and thus the electronic waste and environmental pollution it generates, poses a growing problem that will require innovative solutions1. Many toxic elements and non-biodegradable plastics are commonly found in conventional electronics, and efforts to develop new eco-friendly electronic designs are therefore desirable. Incorporation of natural materials into these designs is advantageous to reduce the quantity of toxic components of the electronic devices. Moreover, natural materials often possess complex and robust physical properties that can be harnessed for electrical and sensor applications. Spider silk (SS) is one such material and the combination of its toughness2 and bio-

compatibility3, 4 makes the material strategically important for implant, electrical, sensor and actuating applications.

SS, a protein-based natural polymer, is a flexible but strong material due to its helical-elastic and β-sheet crystalline composition 5, 6. An unrestrained neat SS fibre expands in both length and diameter 7, 8 when humidified up to ~70 or 80 % relative humidity (RH). At higher RH, the fibre experiences supercontraction 7, 8, 9, 10, where it shrinks in length, expands in diameter and becomes soft. This fibre shrinkage is typically an irreversible process 11. The fibre softening, however, is a reversible process 12. In addition, the fibre also experiences cyclic contraction 11, a phenomenon different from supercontraction, where the fibre extends when exposed to a high-humidity environment. These factors are key to the work presented here.

For technological applications, where constant strength and flexibility in a variable environment are desired, supercontraction may be regarded as a problem. However, both supercontraction and cyclic contraction can be exploited for actuating applications. For example, it has been shown that SS fibres can be used as a biomimetic muscle with an exceptional work density, 50 times higher than other biological muscle fibres, estimated to be capable of lifting a 5 kg mass with a 1mm thick SS fibre 11. SS fibres can also be used as contact 13 or shadow 14 masks during thin film deposition, generating micro-13 or nano patterned14 features without lithographic processing. Moreover, starting from its intrinsic properties, SS fibres can serve as a versatile scaffold upon which additional functions can be built. For example, CdTe 15, magnetite 16 and gold 16, 17 nanoparticles can be used to functionalise SS for fluorescent, magnetic and electronic applications, respectively. Gold-functionalised fibres (Au-SS) have been shown to be electrically robust down to cryogenic temperatures 17. Even though Au-SS possesses sufficient flexibility for use as electrodes in microelectronics 17, generally its elasticity and electrical continuity are not adequate for electronic sensors or actuating devices.

Here we show that supercontraction, and in particular, silk fibre softening, provides a simple and effective route of SS functionalisation with carbon nanotubes (CNTs), enabling use in electronic applications including sensors and actuating devices. We report a strong affinity for amine-functionalised multiwall CNTs (f-CNTs) to adhere to natural Nephila clavipes SS fibres. Adhesion is facilitated by water and mechanical shear, and enhanced by polar interactions and bonding between the SS and f-CNT side groups. The process results in SS fibres uniformly coated with f-CNTs (f-CNT-SS) providing an electrically conducting path, and thereby a self-monitoring mechanism for physical changes and/or stimuli to the f-CNT-SS structure. The f-CNT-SS fibres are ~300 % tougher than neat silk fibre, versatile and multi-functional, and exhibit polar (Supplementary Movie 1), shapeable, conducting, flexible, strain- and humidity-sensitive properties. Proof-of-concept f-CNT-SS-based heart pulse sensor and current-driven actuator devices are demonstrated.

### Results

Water-based f-CNT coating of SS fibres

We discovered that by mixing a bundle of dragline SS fibres (~2 cm long) with a dry powder of f-CNTs (Methods section), applying a few drops of water, and then pressing and shearing the mixture between two Teflon (Polytetrafluoroethylene)

sheets, the fibres turned very black, and when dried, contracted to a well-defined geometry where the silk fibres were uniformly coated with nanotubes (Fig. 1). The neat bundle contained multiple dragline silk fibres in their natural double-stranded arrangement (each strand has a diameter of ~4 µm), all of which were coated simultaneously. After the coating process, the dragline silk fibres were well separated into individually coated single-strand fibres (referred to as single fibres for the rest of the paper), accompanied by small isolated f-CNT aggregates (Supplementary Fig. S1).

This separation allowed reliable extraction of single silk fibres from the bundle. SEM and TEM images of the single silk fibre show that the f-CNTs are attached to the SS structure (Fig. 2a – d), including some penetration of the nanotubes into the SS surface (Fig. 2e). This procedure produces a basic uniform annular f-CNT coating with thickness of ~80 – 100 nm with occasional f-CNT aggregates of ~1 µm in diameter and thickness (Supplementary Fig. S2). Additional SEM and TEM images of another silk fibre are available (Supplementary Figs S1 and S2).

We have also performed a control experiment involving pre-supercontracted fibres. The neat fibres are first immersed in a water bath for 30 min, followed by air drying, and then the water-based f-CNT coating is performed. The water-based procedure is also effective on these pre-supercontracted fibres, indicating that the initial shrinkage of silk fibre is not the most important factor to achieve the effective coating, but it is the softening of the fibre during supercontraction.

We note that a dry powder of pure multiwall CNTs (MWCNTs) does not provide effective initial dispersion and adhesion to the SS fibre (Supplementary Fig. S3). As a result, it is not possible to coat the SS fibre with pure MWCNTs using our water-based method. Likewise, only SS fibres exhibit an effective f-CNT coating compared with nylon, polyester, cotton and some acrylic fibres where either spotty or no coating was observed. Unlike water, other solvents such as hexane, toluene, methanol, ethanol, acetone, dichloromethane and dimethylsulphoxide do not facilitate a uniform coating.

(Published 10 September 2013, Nature Communications)

### *ПИТАННЯ ДО КУРСУ «ОСНОВИ АНОТУВАННЯ ТА РЕФЕРУВАННЯ»*

1. Надайте визначення первинних документів та наведіть приклади.
2. Надайте визначення вторинних документів та наведіть приклади.
3. Розкрийте сутність поняття аналітико-синтетичної обробки документів.
4. Назвіть складові елементи бібліографічного опису.
5. В чому полягає сутність анотування та реферування?
6. Які відмінності існують між анотацією та рефератом?
7. Чи відрізнятиметься трактування термінів «анотація» та «реферат» у сфері бібліографії від їх розуміння в галузі наукових досліджень?
8. В чому полягає основне призначення анотацій та рефератів?
9. Чи всі наукові документи підлягають реферуванню?
10. Чи можуть анотація та реферат замінити першоджерело?
11. Наведіть визначення анотації.
12. Сформулюйте основну мету анотації.
13. Які ви знаєте підходи до класифікації анотацій?
14. Чим відрізняється довідкова анотація від рекомендаційної?
15. Як ви розумієте поняття «спеціалізована анотація»?
16. Як називається анотація, яку укладено на один вихідний документ?
17. Як називається анотація, що висвітлює декілька першоджерел, пов'язаних спільною тематикою?
18. Назвіть основні вимоги, що висуваються до написання анотацій.
19. З яких частин складається анотація?
20. Які етапи зазвичай охоплює робота зі складання анотації?
21. Наведіть визначення поняття «реферат».
22. Яку функцію виконує реферат?
23. В чому полягає сутність індикативної функції?
24. Які критерії покладено в основу класифікації рефератів?
25. Наведіть визначення та схарактеризуйте інформативний реферат.
26. Чим відрізняється загальний реферат від спеціалізованого?
27. Що таке реферат-екстракт?
28. Чи всі документи підлягають реферуванню?
29. Назвіть основні складові структури реферату.
30. Які основні способи реферативного викладу ви знаєте?

**ЗРАЗОК ТЕСТУ З ДИСЦИПЛІНИ**
**«ОСНОВИ АНОТУВАННЯ ТА РЕФЕРУВАННЯ ТЕКСТІВ РІЗНИХ ТИПІВ ТА ЖАНРІВ»**

1. До первинних документів/матеріалів (першоджерел) зараховують:
а) каталоги;
б) статті;
в) анотації;
г) бібліографічні описи.

2. До вторинних документів/матеріалів зараховують:
а) реферати;
б) матеріали конференцій та конгресів;
в) підручники;
г) монографії.

3. Сутність анотування та реферування полягає в:
а) максимальному уточненні та доповненні тексту джерела інформації;
б) максимально адекватному та еквівалентному перекладі змісту першоджерела;
в) максимально повному переказі змісту первинного документа;
г) максимальному скороченні обсягу джерела інформації за збереження його основного змісту.

4. Найбільш стислий, лаконічний вторинний документ, який дозволяє ідентифікувати першоджерело, це:
а) реферат;
б) каталог;
в) бібліографічний запис;
г) конспект.

5. Призначення анотацій та рефератів полягає в:
а) детальному ознайомленні широкого кола читачів зі змістом першоджерела;
б) наданні найсуттєвішої інформації про зміст первинного документа;
в) розповсюдженні інформації про авторів наукових досліджень;
г) наданні роз'яснень про новітні науково-технічні досягнення.

6. Анотації, які містять основні відомості про тематику та проблематику першоджерела та вказують на його призначення для певної цільової аудиторії, називають:
а) загальними;
б) спеціалізованими;
в) оглядовими;

г) рекомендаційними.

7. Анотації, які містять загальні відомості двох чи більше документів, називають:

а) загальними;

б) спеціалізованими;

в) оглядовими;

г) рекомендаційними.

8. Залежно від методів згортання інформації реферати поділяють на:

а) інформативні, індикативні, змішані;

б) монографічні, оглядові, аналітичні;

в) загальні та спеціалізовані;

г) реферати-екстракти, «перефразовані» та реферати-інтерпретації.

9. Під повнотою реферату зазвичай мають на увазі:

а) точний виклад сутності та змісту першоджерела;

б) збереження обсягу першоджерела;

в) відображення деяких суттєвих питань першоджерела;

г) виклад власного ставлення референта до тематики та проблематики першоджерела.

10. Реферат, який в узагальненому вигляді викладає всі основні положення оригіналу, називають:

а) інформативним;

б) індикативним;

в) змішаним;

г) спеціалізованим.

11. Реферування за використання формально-синтаксичного методу характеризується:

а) майже дослівним перенесенням до тексту реферату інформаційних фрагментів першоджерела;

б) семантичною та синтаксичною перебудовою ключових фрагментів першоджерела;

в) інтерпретаційною обробкою тексту першоджерела;

г) широким вживанням абревіатур та скорочень у тексті реферату.

12. Під час укладання реферату компресія первинного тексту здійснюється за рахунок:

а) компресії другорядної інформації;

б) відкидання фрагментів, що містять ключову інформацію;

в) відкидання фрагментів, які містять як ключову, так і другорядну інформацію;

г) відкидання другорядної інформації.

## *КЛАСИФІКАЦІЯ ЛЕКСИЧНИХ КОННЕКТОРІВ*

| № | Найменування класу коннекторів | Приклади |
|---|---|---|
| 1. | **Коннектори, що вказують на зв□язок між об'єктами** | |
| 1.1. | Анафоричні | |
| 1.1.1. | Коннектори схожості та розбіжності | The, this, such, another, other |
| 1.1.2. | Коннектори-замісники | He, she, one, those |
| 2. | Катафоричні | The following |
| | **Коннектори, що вказують на логічний зв□язок між цілими реченнями (судженнями)** | |
| | Анафоричні | |
| 2.1.1. | Темпоральні | Simultaneously, then, thereafter |
| 2.1.2. | Коннектори-локалізатори | Here, there |
| 2.1.3. | Уточнюючі коннектори | In particular, for example, for instance |
| 2.1.4. | Результативні | Finally, in total, as a result, thus, at last |
| 2.1.5. | Причинно-наслідкові | Therefore, thus, then, so, hence |
| 2.1.6. | Перифрастичні | In other words, moreover, in addition to, additionally, apart from this, besides this, in this connection |
| 2.1.7. | Порівняльні | Similarly, likewise |
| 2.1.8. | Доповнення | Also, besides, furthermore, otherwise, briefly, in brief, exactly, in short, that is to say, to sum up, to put it in a word |
| 2.1.9. | Протиставні | But, yet, however |
| 2.1.10 | Підтверджувальні | Indeed, really |
| 2.1.11. | З'єднувальні | And |
| 2.2. | Катафоричні (пояснювальні) | Namely, let |
| 2.3. | Двосторонні | Firstly, secondly |

## *СЛОВА «ЗАГАЛЬНОГО» ЗНАЧЕННЯ*

| | |
|---|---|
| Слова найбільш широкого значення | Problem, fact, phenomenon, matter, subject, object, case, observation, interpretation, regard, question, notion, situation, picture, instance, event, circumstance, field, data, thing, information |
| «Результат» | Result, consequence, response, solution, conclusion |
| «Причина» | Reason, rationale, explanation |
| «Вплив» | Effect, influence, impact |
| «Розбіжність» | Difference, distinction, discrepancy |
| «Дія» | Work, job, practice, experiment, action, process, activity, measure, decision |
| «Взаємодія» | Combination, interaction, relation |
| «Модальність» | Argument, requirement, condition, restriction |
| «Властивість» | Property, characteristic, advantage, feature, behaviour, quality, quantity |
| «Спосіб» | Way, approach, method, technique |
| «Точка зору» | Theory, idea, phrasing, view, viewpoint, thought, concept, conjecture, position, idea, assumption, hypothesis, statement |
| «Мета» | Aim, task, purpose, goal, intention, end |
| «Тенденція» | Trend, tendency, prognosis |
| «Зміна» | Increase, decrease, change, improvement, surplus |
| Інші слова «загального» значення | Chance, emphasis, oversight, possibility, pathway, frame, application, juncture, movement, site, bit, recognition, pattern, gap, calculation, finding, level, flexibility, plasticity, difficulty |

# ЛІТЕРАТУРА

1. Варенко В.М. Референтна справа. Навчальний посібник / В.М. Варенко. – К. : Кондор, 2008. – 212 с.

2. Гребінник Г.Ю. Анотування та реферування англійською мовою загальнонаукової та фахової літератури / Г.Ю. Гребінник, Г.І. Дідович, Г.В. Комова – Х. : НТУ «ХПІ», 2010. – 192 с.

3. Основні методи автоматизованого реферування [Електронний ресурс]. – Режим доступу : http://uadocs.exdat.com/docs/index-140602.html

4. Смірнова Є.С. Англійська мова : навч.-метод. посіб. // Є.С. Смірнова, Г.А. Чередниченко. – К. : НУХТ, 2011. – 180 с.

5. Сорока М.Б. Національна система реферування української наукової літератури [Електронний ресурс] / М.Б. Сорока ; НАН України, Нац. б-ка України імені В.І. Вернадського. – К. : НБУВ, 2002. – 212 с. – Режим доступу : http://archive.nbuv.gov.ua/libdoc/02smbunl.htm

6. Wikipedia : The Free Encyclopedia [Електронний ресурс]. – Режим доступу: http://en.wikipedia.org/wiki

# ЗМІСТ

Навчальне видання


**Вороніна** Камілла Владиславівна


# ОСНОВИ ПЕРЕКЛАДАЦЬКОГО АНОТУВАННЯ ТА РЕФЕРУВАННЯ ТЕКСТІВ РІЗНИХ ТИПІВ І ЖАНРІВ

Навчальний посібник
(Укр., англ. мовами)