



## Technologies to transform assessment: a study of learning outcomes, assessment and technology use in an Australian university

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Emerging Web 2.0 technologies have frequently been touted as having the potential to transform learning and assessment, with their capacity to capture the processes and not just products of collaboration and creativity. While the literature is optimistic, questions emerge about the impact these tools have had on academic practice and the extent to which they have been able to rise to this challenge of changing assessment strategies and processes in universities.

This paper reports the findings from a survey of unit convenors in an Australian university, which explored how technologies were used to support assessment. The results suggest that while uptake of technologies for assessment may slowly be rising, the uses are frequently limited to assessing students' ability to understand or apply concepts or procedures. The potential of technologies to support assessment of the all-important higher order learning outcomes such as evaluation, creation and metacognition is still largely left untapped. For many of the technologies, the results suggest that rather than transformative tools, their uses are predominantly limited to perpetuating traditional practices.

Key words: assessment, educational technologies, higher order learning, Web 2.0 technologies

### Introduction

New social technologies mean that universities have the chance to create a new generation of student-centred learning environments, to realize the idea of a University 2.0 (Barnes & Tynan, 2007, p. 189)

Educational technologies have become part of mainstream teaching practice in many institutions. For example, Macquarie University has as part of its Learning and Teaching Plan a requirement that all units

have at least a minimal online presence and the use of the University's Learning Management System (LMS) and the digital recording of lectures for online access is widespread.

Although widely recognized as a key driver of student activity (Ramsden, 1992), assessment has been an area slower to incorporate new technologies than other aspects of teaching and learning (Byrnes & Ellis, 2006; Ellis & Goodyear, 2010). Byrnes and Ellis 2006 found in a study of technology uses in Australian universities, that beyond online quizzes and discussion forums, few other online assessment tools were reported. Contributing to this prevalence of quizzes and discussion forums is their availability as part of many university Learning Management Systems (LMS) and their relative ease of use. While they have the potential to offer efficiencies for academics, there are often criticized for their frequent focus on developing objective tests (Nicol & Milligan, 2006 ) which primarily target lower order skills (Biggs, 2003; Crisp, 2007; Northcote, 2003). For example one learning and teaching centre cited as a common concern, 'If lower-order learning is an unintended educational consequence of online assessment, any perceived or real gains made in efficiency, staff workload reduction and/or cost saving are at a questionable price' (James, McInnis, & Devlin, 2002, p. 23).

## Higher order learning outcomes

In revising Bloom's (1956) original taxonomy, Anderson et al (2001) switched the top two levels to include a 'creation' category as the top cognitive process dimension and reformatted the nouns to verbs to signify learning as activity. They also developed a matrix by adding a knowledge dimension. The matrix format was selected to highlight the array of possible objectives and the relationship between them (2001). Of particular interest in this study were the lower right hand categories, denoted by the diagonal pattern. These skills, associated with critical thinking, creativity and self-assessment, are included in many university's mission statements and form the basis of life-long learning, the 'raison d'être of a higher education' (Boud & Falchikov, 2006, p. 399).

**Table 1: The revised Bloom's taxonomy**

knowledge dimension	The cognitive process dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual						
Procedural						
Meta-cognitive						

Proponents of the emerging Web 2.0 and social networking tools suggest they support more diverse and flexible assessment strategies, including those targeting higher order outcomes. For example, Shepherd (2009) raises the possibility that blogs and wikis have the potential to capture both the processes of student learning and the final artefact to be submitted, in either collaborative or individual contexts (Boulos, Maramba, & Wheeler, 2006; Churchill, 2007; Hewitt & Peters, 2006; Judd, Kennedy, & Cropper, 2010; Ladyshevsky & Gardner, 2008; Trentin, 2009). Reflecting on and documenting the journey and the collaborative process can help make explicit the process of learning; important for the development of metacognitive, self regulatory skills (Butler & Winne, 1995). E-portfolio tools enable the compiling and sharing of resources, which has the added benefit of enabling student to make explicit links between facts, concepts and ideas (Himpsl & Baumgartner, 2009); a process which helps in establishing interrelated knowledge networks (Khalifa & Kwok, 1999). Virtual worlds, which often use some of the Web 2.0 capabilities to support networking and collaboration, can enable students to role play or simulate

experiences otherwise impossible, such as those in nano scale (de Freitas, 2006; Johnson & Levine, 2008). For many of these technologies, student engagement is raised as a key benefit (Ellison & Wu, 2008; Lobb & McDonnell, 2009; McLoughlin & Lee, 2010; Neumann & Hood, 2009).

While Shepherd suggests that these technologies could enable higher education to ‘better assess aspects of learning that have proved difficult to assess using more conventional means’ (2009, p. 386), this also raises questions about academic practice and the recognition of the affordances of these technologies to transform assessment. The literature has many examples of innovative practice in using technologies, however Maor (2006) suggests that a tension often exists between pedagogy and technology, where academics are unsure how to implement technologies to match the learning outcomes they intend for their students.

This study examined academics’ perceptions about the affordances of the social networking tools for supporting assessment of higher order learning at an Australian university. This survey was undertaken to explore the types of learning outcomes unit convenors intended when they used a range of technologies.

## Method

This survey was designed to explore academic perspectives about the affordances of social networking tools to support assessment of higher order learning. Specifically it explored:

- the technologies used for formative or summative assessment;
- the types of learning outcomes the respondents targeted in using these technologies; and
- their attitudes toward the role of assessment and the alignment of their units in general.

The convenors of online units using the University’s LMS during Semester 1, 2010 were invited to participate in the survey. Academics already using technology in their teaching were targeted. These academics were already working in an online environment and have an understanding of the limitations of that environment. The survey was designed, using Anderson et al’s (2001) Taxonomy as a framework, to categorise the types of learning outcomes the unit convenors intended for their students. The survey development software ‘SurveyMonkey’ was used to deliver the survey, with 734 unit convenors invited to participate.

## Results

Of the 734 academics invited to participate, 180 responded to the survey (24.5 %).

The first questions asked about the context of the chosen units. Table 1 lists discipline areas the units were from, using DEWR discipline categories.

**Table 1: Discipline representation**

<b>Discipline</b>	<b>Percentage</b>	<b>Responses</b>
Humanities	30.5%	54
Psychology	4.0%	7
Business	9.6%	17
Life Sciences	20.5%	35
Education	17.0%	30
Law	4.0%	7
Health	1.7%	3
Economics	2.3%	4
Maths/Physics	7.4%	13
Comp Science	2.8%	5
<b>TOTAL</b>		<b>175</b>

Although response levels were very low from some departments, there were participants from a wide range of discipline areas and all faculties were represented.

Post-graduate units were most commonly represented, followed by the middle years of undergraduate programs. Table 2 presents information about the unit level.

**Table 2: Unit level**

Unit level	Response percent	Response count
Undergraduate - first year	21.2%	38
Undergraduate - middle years	29.1%	52
Undergraduate - final year	17.9%	32
Post-graduate	31.8%	57
<b>TOTAL</b>		<b>179</b>

The highest representation was from units with a mixture of internal and external enrolment modes, followed by internal only modes, as reported in Table 3.

**Table 3: Enrolment modes**

Enrolment mode	Response Percent	Response Count
Internal students	41.6%	74
Mixture of internal and external students	51.1%	91
External students	7.3%	13
<b>TOTAL</b>		<b>178</b>

## Technology usage

The survey was designed to explore how the unit convenors used the various technologies, specifically online quizzes, discussion forums, wikis, blogs, online portfolios and virtual worlds. The next series of questions asked respondents to indicate which technologies they used in their unit and if so, whether they were used for summative assessment; contributing to students' final grade or formative assessment; to provide feedback on their learning without grades attached. Although each of the technologies is explored in more detail in the sections to follow, a summary of overall usage of technologies is presented in Table 4.

**Table 4: Technology usage**

Uses	Online quizzes	Discussion forums	Wikis	Blogs	Online portfolios	Virtual worlds
I use the technology in the unit's assessment	25.3% (45)	25.0% (44)	2.9% (5)	4.7% (8)	3.5% (6)	1.2% (2)
I use the technology in the unit but not to count towards assessment	7.9% (14)	<b>48.3%</b> (85)	2.9% (5)	5.9% (10)	2.4% (4)	1.8% (3)
I don't use use the technology in this unit	<b>66.9%</b> (119)	26.7% (47)	<b>94.2%</b> (161)	<b>89.3%</b> (151)	<b>94.1%</b> (160)	<b>97.0%</b> (164)
<b>TOTAL</b>	178	176	171	169	170	169

All the technology options were used by at least some of the participants, with online quizzes and discussion forums most used. Wikis, online portfolios and virtual worlds were used by small numbers of respondents.

The tendency suggested by earlier studies (Byrnes & Ellis, 2006; Ellis & Goodyear, 2010) for academics to introduce technology into formative elements of their assessment strategies or tasks with few marks attached, was also explored in the survey. While the high-stakes nature of summative assessment frequently provides a barrier to the use of technologies (Crisp, 2007), there are many examples in the literature of tools to provide feedback on student learning and enable them to gauge their own progress towards learning goals (Cubric, 2007; Jenkins, 2005; McLoughlin, 2003; Wang, 2007).

Figure 1 is a graphic representation of the uses of the technologies for summative and formative assessment. Series One represents the use of the technologies for summative assessment and Series Two represents technologies' use for formative purposes and not to count toward the final grade. The x axis represents the number of units using each technology.

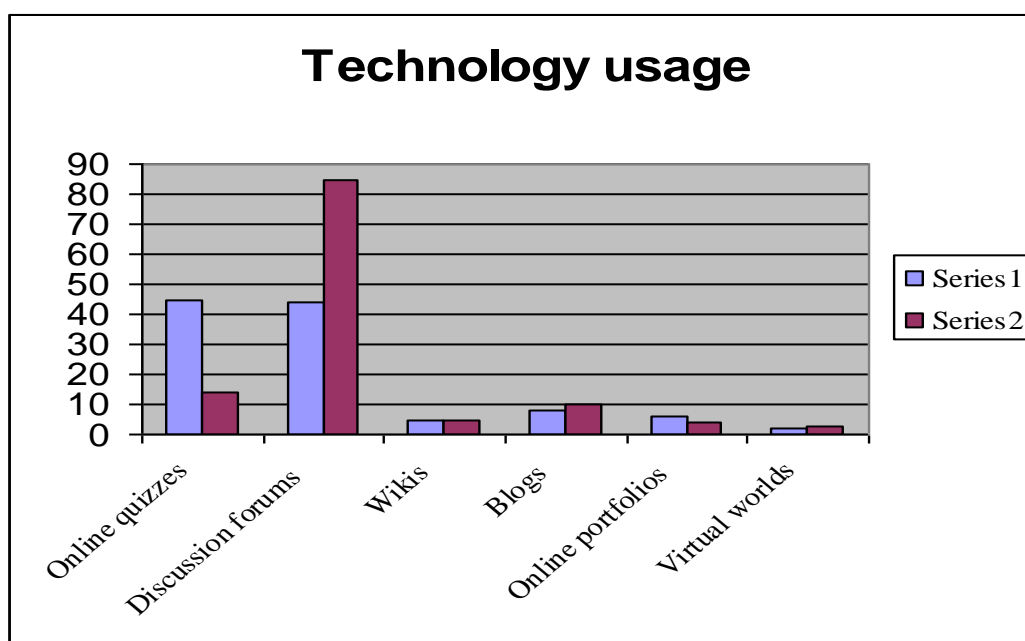


Figure 1: Summative and Formative uses

While almost 75% of respondents indicated that they use discussion forums in their unit, they were most widely used for formative assessment. In contrast, online quizzes were most widely used for summative assessment.

For each of the technologies, respondents were asked about the extent to which they targeted specific outcomes. Table 5 summarises the responses for all technologies, used to a large or moderate extent to assess the various categories of learning outcomes from Anderson et al (2001) framework.

Table 5: Technologies as targeting specific learning outcomes

Answer Options	Quiz	Discussion forum	Wikis	Blogs	Online portfolios	Virtual worlds
<b>recognise</b> or recall information, concepts or procedures	<b>80.7%</b> (46)	28.8% (33)	22.2% (2)	37.5% (6)	44.4% (4)	33.3% (2)
<b>understand</b> , explain, categorise or summarise information	58.2% (32)	45.4% (54)	66.6% (6)	55.6% (10)	40.0% (4)	33.3% (2)
<b>apply</b> information, concepts or procedures in a range of situations	45.5% (20)	<b>63.5%</b> (52)	66.6% (6)	55.6% (10)	60.0% (6)	33.3% (2)
<b>analyse</b> , organise or deconstruct	29.7%	45.3%	66.7%	44.5%	50.0%	33.3%

concepts, procedures or scenarios	(16)	(53)	(6)	(8)	(5)	(2)
<b>evaluate</b> or make judgements about concepts, situations, procedures or hypotheses	33.9% (18)	52.1% (62)	60.0% (6)	55.6% (10)	60.0% (6)	<b>60.0%</b> <b>(3)</b>
<b>create</b> , design or construct hypotheses ideas, products, procedures or scenarios	7.6% (4)	28.0% (32)	<b>80.0%</b> <b>(8)</b>	47.0% (8)	60.0% (6)	33.3% (2)
<b>critique</b> or evaluate their own knowledge or performance	35.8% (19)	39.1% (45)	44.4% (4)	<b>72.2%</b> <b>(13)</b>	<b>70.0%</b> <b>(7)</b>	33.3% (2)
<b>Responses</b>	<b>57</b>	<b>121</b>	<b>10</b>	<b>18</b>	<b>10</b>	<b>6</b>

The two most commonly used tools, discussion forums and online quizzes had the highest response rate for the categories of application and recall respectively. Of the 57 respondents, 46 indicated that they used quizzes to assess whether students could recognize or recall information, concepts or procedures. Students' ability to understand or apply information also featured highly. Discussion forums were the most widely used of all options in the survey, with 129 of the total 176 respondents (73.3%) indicating they used them.

There were examples in the sample of respondents using wikis, blogs, online portfolios and virtual worlds for higher order outcomes. Of the 10 respondents using wikis, eight indicated that they targeted creativity as a higher order learning outcome. Metacognitive knowledge, where students were assessed on their ability to critique or evaluate their own performance, featured most highly in the use of blogs and online portfolios, followed by understanding and evaluation. Evaluation was the target with the highest rating for virtual worlds, although it is difficult to draw conclusions from such small numbers of respondents. Creation tasks featured strongly for wikis and online portfolios.

### Other purposes for using the technologies

Along with the learning outcomes targeted, respondents were asked about other purposes for using the specific technologies, with categories based on the findings of an earlier study (see McNeill, Gosper and Hedberg, 2008, 2010). Respondents selected those options relevant to their unit and responses for the various technologies were combined into Table 6. Not all purposes were offered as option for each technology, as indicated by the N/A in the boxes.

**Table 6: Technologies and how they were used**

Affordances	quiz	discussion	wikis	blogs	e-portfolios	virtual worlds
-to encourage students to <b>keep up with the content</b>	<b>87.3%</b>	60.7%	11.1%	55.6%	50.0%	40.0%
-to encourage <b>student participation</b> in the unit	58.2%	86.1%	<b>77.8%</b>	<b>83.3%</b>	62.5%	20.0%
-to provide <b>feedback</b> on students' learning	72.7%	45.1%	22.2%	44.4%	50.0%	40.0%
-to enable students to <b>discuss</b> their learning with their peers	N/A	<b>93.4%</b>	<b>77.8%</b>	72.2%	25.0%	20.0%
-to capture student <b>collaborations</b> during learning	N/A	30.3%	44.4%	22.2%	12.5%	20.0%
-to capture students' <b>reflections</b> during their learning	N/A	45.9%	55.6%	55.6%	62.5%	40.0%
-to enable students to store or <b>share</b> their learning	N/A	50.8%	66.7%	50.0%	<b>75.0%</b>	20.0%
-to <b>simulate</b> real experiences	N/A	N/A	N/A	N/A	N/A	40.0%
-to <b>design</b> and create objects	N/A	N/A	N/A	N/A	N/A	20.0%
-to <b>immerse</b> themselves	N/A	N/A	N/A	N/A	N/A	<b>60.0%</b>
Responses	55	122	9	18	8	5

These options for each of the technologies related more to the processes of learning rather than the outcomes. Participation features highly in all technology uses. There are indications that some of the respondents recognized aspects of the affordances of the various tools, for instance, a high proportion of those using discussion forums, wikis and blogs indicated they used these partly to enable students to discuss learning with their peers. In response to the question about the processes for which quizzes were used, most convenors indicated they used them to encourage students to keep up with the content or to provide feedback on student understanding of the ideas. When asked about the processes behind the selection of blogs in the unit, again participation and discussion featured most highly, although the affordances of blogs for capturing reflections and encouraging peer sharing of work were also represented. Storing and sharing examples, followed by capturing reflections and encouraging participation rated highly. For virtual worlds, 60% agreed that this was partly to enable students to be immersed in the particular learning environment.

For each of the questions, there was a text field where respondents could add additional comments about the particular technology. Most respondents reiterated or elaborated on the categories above, for example:

I use an online quiz as an early assessment task to consolidate key concepts and to encourage engagement in the unit.

Some of the comments related to course-related administration, such as the use of a discussion forum:

To nominate choices for assignment topics - ensuring each student works on a different topic.

## Discussion

The results indicate that the use of technologies in the assessment of learning is still relatively low. Of the 180 respondents, most convenors of units delivered using the University's LMS, do not use any technologies for assessment of learning. Discussion forums were most widely used, with 73% of respondents using these tools mostly for formative assessment. Quizzes, second most frequently used, were used by 33% of respondents. Some tools such as wikis, e-portfolios and virtual worlds had very low numbers of respondents indicating their use, perhaps because their use requires academics to venture outside the more familiar environment of the University's LMS system and its centralized support.

While there are examples where convenors do use technologies to target higher order outcomes, the traditional focus of technology-supported assessment on lower order outcomes is still very apparent. All technologies were used by at least some of the respondents to target the lower order outcomes in Anderson et al's framework (2001) and the use of quizzes to assess recall was most highly rated overall.

Although those technologies with the highest levels of usage (online quizzes and discussion forums) were those predominantly targeting the lower order outcomes of recall or application, the results suggest there are positive signs and some technologies are being used by some academics to support the assessment of higher order outcomes. Of the relatively small number of respondents who are using the social networking technologies such as wikis, blogs, e-portfolios and virtual worlds, many recognize their affordances for supporting the assessment of higher order outcomes. Examples include wikis for assessing students' creative tasks and blogs for assessing their capacity for metacognition.

The technologies other than quizzes employed suggest that there is a trend towards the middle of the matrices – not recall but not creativity or meta-cognition. As suggested by Race (2001) and Shepherd (2009), the tendency is still toward assessing those things that are easy to assess and often less important. Small numbers of academics are using the social networking tools to support assessment of higher order learning, with blogs and online portfolios most likely to be used to support assessment of higher order outcomes.

Most of the questions about the different tools elicited high numbers of 'Not applicable' ratings, especially in relation to the types of outcomes typically considered to be difficult to assess such as metacognition.



While there are certainly differences in the levels of learning that units may target, some convenors indicated that they did not target outcomes higher than application. While concerning, this is reflected in their choice of tools, with lower order outcomes and lower order uses of technology.

Some comments suggest that respondents may have poorly understood the concept of higher order thinking, for example one response had online quizzes being used for assessing creativity. The closed nature of the quiz tools makes it unlikely for students to demonstrate creativity. Responses about the use of quizzes also suggest some confusion about the option of *critique or evaluate their own knowledge or performance*. Some respondents used quizzes for students to assess themselves as a formative process, rather than linked to an outcome related to metacognition. The implications of this are that academic staff need assistance in expressing learning outcomes and also in matching their assessment tasks and tools to elicit these outcomes.

Many convenors surveyed have recognized the affordances of some of the more commonly used tools such as quizzes and discussion forums, but the theme of missed opportunity emerged with examples of all technologies being used for recall, despite the affordances of the tools for other types of assessment. For instance, while 72.2% of respondents reported using blogs to assess students' capacity to critique or evaluate their own knowledge or performance, recall was targeted by 37.5% of respondents and understanding by 55.6% (n=18).

The reasons the respondents used the technologies echoes the theme of engagement that emerged strongly from the literature, with encouraging students to keep up with the content and participate in the unit activities selected by many respondents. Overall, to encourage students to discuss their learning featured highly for all technologies, emulating the 2010 Horizon Report's emphasis on technologies that support collaborative learning environments: "the key is the interactions they enable, not the technologies they include" (NMC, 2010, p. 13). Encouragement for students to participate in the unit, another engagement strategy, was one of the most common reasons for the use of the individual tools.

There were instances of convenors recognizing the affordances of different tools, such as storing and sharing examples of their learning in e-portfolios and the possibility of immersion in a learning environment in virtual worlds. This also featured in the single comment relating to virtual worlds: *To experience a virtual learning environment*.

One of the limitations of the study was that participation was invited from convenors using the University's central LMS. This presupposes a certain familiarity with technologies that would not be representative of the campus as a whole. To some degree, the use of technologies at all may have encouraged some reflection about curriculum alignment among this group of academics. Those convenors who use other LMS and social networking systems that are not centrally supported were not captured in the survey. Another limitation is that participants in the survey were asked to base their responses on the unit that they considered to be the best example of using technologies to assess a range of learning outcomes. Therefore, there may be other examples in other units, but these were not captured.

Nonetheless, initial analysis of the data suggests that relatively small numbers of convenors are using technologies to transform assessment – most of those using the most common tools focus on lower order outcomes as found in earlier studies (Byrnes & Ellis, 2006; Ellis & Goodyear, 2010). Within the sample, there are encouraging signs that some respondents have focused on higher order outcomes, especially in relation to the emerging web 2.0 tools, which indicates that the affordances of these tools may have been recognized. There are also those who indicated targeting lower order outcomes regardless of the tools they used and some who indicated that higher order outcomes were 'Not applicable' to any technology use in their unit.

## Conclusion

Perhaps the transformation of assessment will be slower than some advocates of technologies and curriculum reform would wish, but the results of this study are promising. The literature has a plethora of



examples of the affordances of social networking tools such as blogs, wikis, virtual worlds for learning, yet the results suggest that these tools are still relatively uncommon in academic practice. The most commonly used tools for assessment were online quizzes and discussion forums; the tools typically associated with the pedestrian use of LMSs. Results from a recent study conducted at the University into student experiences with technologies for learning suggest that the students also predominantly use these more traditional tools. Of the 1104 students surveyed in April 2010 about their uses of technologies in general and in particular for their learning, there was again a tendency toward a conservative approach, using older, more familiar and often cheaper technologies. While this student use of technologies may mirror the attitudes of staff in what they design into their units, there are similar patterns emerging in student use of technologies other than for learning. When student respondents were asked about the technologies they used for social or work purposes, most common were email (94%), text messaging (90%) and mobile phones for voice messages (80%). Wikis were recorded as being used by 29% of respondents, blogs by 20% and virtual worlds by 3%.

Perhaps academics and students alike are changing slowly.

The findings of the surveys provide insights into how technologies are used in one Australian university, suggesting that as technology use grows, there is a continuing focus on lower order learning outcomes. Small numbers of convenors are exploring the affordances of emerging technologies and there are instances of these being used to support assessment of outcomes such as creativity or metacognition. The survey in this study elicited rich data about other issues such as the respondents' beliefs about the role of assessment and their confidence in curriculum design with technologies, which are outside the scope of this paper. Further analysis will be undertaken to explore the differences between formative and summative assessment, undergraduate versus postgraduate units and links between the technology uses indicated by the respondents and their attitudes toward assessment and curriculum design. This will help establish a greater understanding of whether the apparent focus of technology usage on lower order learning outcomes is indicative of a more wholesale focus on perpetuating rather than transforming assessment, at the expense of those ever-elusive higher order outcomes.

Researchers such as Prensky (2001), Oblinger (2003) and Barnes and Tynan (2007) suggest that higher education needs to be transformed by adopting some of these emerging technologies, to make the educational experience more relevant and meaningful for the young students coming through. This study was undertaken, in part, to explore how this transformation has affected one Australian University; to document how widely technologies such as Web 2.0 tools were used across campus and, whether their heralded affordances had influenced a transformation rather than a continuation of traditional assessment practices. The results suggest that while the potential for emerging Web 2.0 technologies to support transformation of assessment is recognized by some, relatively few academics have seized this opportunity. The most widely used tools are predominantly used to target lower order outcomes such as recall or application of concepts or procedures. Even within the small number of convenors who did indicate that they used the web 2.0 tools, similar tendencies were also present, suggesting that not all the academics understood the affordances of these tools and were instead using them to perpetuate the same assessment focus - not exactly transformation yet.

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